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ABSTRACT

'TEACHING IN IPI' IS AN INTRODUCTORY PROGRAM DESIGNED TO EQUIP THE TEACHER WITH THE BASIC SKILLS REQUIRED TO PLAN AND CONDUCT IPI IN THE CLASSROOM. IT COMPRISES FIVE VOLUMES, OF WHICH THIS--DIVIDED INTO TWO SECTIONS: AN OVERVIEW OF INDIVIDUALIZED INSTRUCTION AND IPI, AND BEHAVIORAL OBJECTIVES AND THE IPI MATHEMATICS CONTINUUM--IS THE FIRST. SECTION I DEALS WITH THE HISTORY OF INDIVIDUALIZATION, AN OVERVIEW OF INDIVIDUALIZED INSTRUCTION AND HOW INSTRUCTION IS INDIVIDUALIZED, IN EACH CASE CONSIDERING THE PHASES OF PRETEST AND POSTTEST. NEXT IT GIVES AN OVERVIEW OF IPI AND HOW INSTRUCTION IS INDIVIDUALIZED IN IT; A DIRECTOR AUDIO-VISUAL TAPE, SAMPLE ITEMS, WORKSHEETS AND A MATHEMATICS CONTINUUM ARE PART OF THESE. A SUMMARY SHEET AND A GLOSSARY OF TERMS CONCLUDE THE SECTION. SECTION II DISCUSSES BEHAVIORAL OBJECTIVES IN IPI MATHEMATICS, HERE USING A SECOND DIRECTOR TAPE (AUDIO), AND THE ORGANIZATION OF THE MATHEMATICS CONTINUUM. A SUMMARY SHEET CONCLUDES THIS SECTION AND THIS VOLUME. (GO)

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TEACHING IN IPI

RESEARCH FOR BETTER SCHOOLS, INC.

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volume I

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TEACHING IN IPI

(A Program of Teacher Preparation)

by

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Teaching in IPI is an introductory program to IPI. It is designed to equip the teacher with the minimal skills needed to plan and conduct IPI in the Classroom.

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Volume 1

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TEACHING IN IPI

Section I

AN OVERVIEW OF INDIVIDUALIZED INSTRUCTION AND IPI

A. History of Individualization

B. Overview of Individualized Instruction

C. How Instruction is Individualized

D. Overview of IPI

E. How Instruction is Individualized in IPI

Suggested setting: 1. Individual work
2. Group of 3-5

This section is designed to present the elements of a generalized system of individualized instruction and to describe how a teacher uses them to individualize instruction in the classroom. In addition, this section introduces IPI as a specific system of individualized instruction and describes how the elements of IPI help the teacher individualize instruction.

HISTORY OF INDIVIDUALIZATION

PRETEST: Section I: History of Individualization

The following items constitute a pretest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Directions:

1. Take the pretest.
2. Use the answer key immediately following the pretest to correct your work.
3. Work on the pages to which you are directed by the pretest answer key.
4. Take the posttest.
5. Use the answer key immediately following the posttest to correct your work.
6. Move on to the next pretest if you have scored 100%.
7. Work on the pages to which you are directed by the posttest answer key if you have scored under 100%. Discuss these pages with other teachers working through this section.
8. Use the pretest as a posttest. (Alternate using the two test forms.)
9. Work toward 100% mastery.

Answer true or false:

1. The attempts to individualize instruction extend back into the beginning of American education. ________

2. IPI is the first systematic plan designed to individualize instruction. ________

3. Experimentation with individualized instruction has shown that this type of instruction can increase motivation and reduce retardation of students. ________

ANSWER KEY

PRETEST: Section I: History of Individualization (pp. 6-8)

1. True
2. False
3. True

HISTORY OF INDIVIDUALIZATION[1]

Individually Prescribed Instruction is a procedure designed to permit the school to more nearly meet the needs of the individual pupil. As such it is a part of a rather long term tradition in the historical development of education. Most educators and psychologists have long recognized the importance of adapting instruction to the individual, but efforts to achieve this, although quite numerous, have never been fully successful. To understand the place of IPI it is useful to have some comprehension of the previous history of efforts in this area. This is a brief introduction to this background. The reader is encouraged to supplement this by additional study in other sources.

A survey of the history of instruction indicates that formal learning began very much as an individual affair; that is, pupils came to school to receive instruction individually from the teacher. Education was generally for a select few; therefore, fewer pupils attended school. This made possible the provision of individualized instruction for those students.

For example, in the one-room school pupils proceeded on an individual basis rather than as intact groups. As education involved a larger and larger fraction of the population, it became necessary to deal with pupils in grade-level groups, and individualized instruction diminished.

---

[1] This brief history of individualization has been drawn from Scanlon, Robert G., Factors Associated With a Program for Encouraging Self-initiated Activities by Fifth and Sixth Grade Students in a Selected Elementary School Emphasizing Individualized Instruction, Doctoral Dissertation, University of Pittsburgh, 1966.

However, as knowledge of the significance of awareness of differences among pupils has increased, many efforts have been made to individualize instruction, even within the context of schools offering mass education.

Systematic plans for providing instruction on an individual basis date back as far as 1888 with the work of Preston Search. Washburne and Billet point out that the efforts of Frederick Burk in developing materials for individual instruction are among the best known.

Shane reviewed individual differences in the historical perspective of school organization plans. He notes that:

> In general, during the past century, educators have endeavored: (a) to reduce individual differences found in non-graded schools of the seventeenth and eighteenth century by introducing grade levels, (b) to make the graded approach less arbitrary by permitting pupils to progress at different rates of speed on "multiple-tracks" or individualized programs, (c) to organize students within a given grade level through ability grouping, and (d) to introduce ungraded grouping, especially during the early elementary years, as in Milwaukee during the early 1940's.

A historical overview of organizational plans since 1850 indicates that there has been considerable debate and little agreement on the best framework for teaching and learning. Old ideas have continually reappeared on the educational scene. A genuinely novel approach has occasionally made its appearance, but no one best kind of classroom organization has ever found universal acceptance. Shane further notes that the historically significant plans dealing with individual differences within the organization of the school have been related to grouping for instruction.

Experimentation with individualized instruction has demonstrated that it can produce desirable results. Several researchers have noted that individualization of school programs show evidence of the following:

time is saved; retardation of students is reduced; a motivating factor is present. Henderson and others conclude, "Paced instruction designed to insure success as a reward for individual effort is a prominent characteristic of most corrective programs." They further state, "It is possible that a major effect of this technique is a gradual development of a new self-reliance, which releases the child from a dependence upon others and permits him to deal more effectively with the printed page." Mayer-Oakes reports a gain of 25 per cent in proportion of students passing the state-wide examination after experience with the Dalton Plan. Peters' findings, based on thirteen experiments, note favorable results for individualizing instruction when comparing the contract plan and the recitation method.

Berson, Jones and Jones, Webster and others and Goodlad and Anderson have provided research to substantiate great differences among individual pupils. These researchers clearly state that great differences in physical development, motor, intellectual, emotional, and social behavior do exist. Research efforts of Washburne and Marland, Jones, and Peters note attempts to provide for individual differences. Jones also points out that when provisions are made for some of the differences, classroom instruction can be made more effective.

This limited review of individual differences and attempts at individualized instruction is by no means complete. The previous brief overview only highlights some of the research and programs concerned with individual differences.

POSTTEST: Section I: History of Individualization

The following items constitute a posttest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Use the directions given with the pretest.

Answer true or false:

1. The concern with individualizing instruction is a recent development in the United States. __________

2. Multiple track programs and ungraded groupings have been used to increase the individualization of instruction. __________

3. Research has shown that classroom instruction becomes more effective when provisions are made for individual differences. __________

ANSWER KEY

POSTTEST: Section I: History of Individualization (pp. 6-8)

1. False
2. True
3. True

OVERVIEW OF INDIVIDUALIZED INSTRUCTION

OVERVIEW OF INDIVIDUALIZED INSTRUCTION

The teacher defines a system of individualized instruction:

1. Names the major components and explains how they work together.
2. Discriminates between instances of individualized and group instruction.
3. Describes the required characteristics of each component.

PRETEST: Section I: Overview of Individualized Instruction

The following items constitute a pretest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Directions:

1. Take the pretest.
2. Use the answer key immediately following the pretest to correct your work.
3. Work on the pages to which you are directed by the pretest answer key.
4. Take the posttest.
5. Use the answer key immediately following the posttest to correct your work.
6. Move on to the next pretest if you have scored 100%.
7. Work on the pages to which you are directed by the posttest answer key if you have scored under 100%. Discuss these pages with other teachers working through this section.
8. Use the pretest as posttest. (Alternate using the two test forms.)
9. Work toward 100% mastery.

Answer true or false:

1. Individualized instruction is designed primarily for the few student's in a class whose learning needs are so different that they demand special attention. ________

2. In individualized instruction, it is permissible to use small group instruction. ________

3. A teacher identifies five students having repeated difficulties with addition in solving two-step problems. This is an example of individualized instruction. ________

4. The teacher organizes her class into high, average and low reading groups based on reading inventory scores. This is an example of group instruction. ________

5. The teacher guides the class through a systematic review of the science assigned to the previous grade. This is an example of group instruction. ________

6. Individualized instruction limits the materials groupings and teaching methods used in a class. ________

7. Teaching methods are used to get the student together with the selected materials and equipment. ________

8. Individual rates of progress are possible when instructional time is varied for each group of students. ________

9. In selecting materials and equipment the teacher chooses those items that are matched to the students instructional objective. ____________

10. Both student and teacher work toward mastery of the instructional objective. ____________

Complete:

1. Student behavior gives the teacher information about the student's:

   a. ______________________________

   b. ______________________________

   c. ______________________________

2. The six kinds of instructional resources used by a teacher to individualize instruction are:

   a. ______________________________

   b. ______________________________

   c. ______________________________

   d. ______________________________

   e. ______________________________

   f. ______________________________

ANSWER KEY

18-28

PRETEST: Section I: Overview of Individualized Instruction (pp.

True-False:

1. F
2. T
3. T
4. T
5. T
6. F
7. T
8. F
9. T
10. T

Completion:

1. a. Mastery of instructional objective
   b. Learning needs
   c. Learner characteristics

2. a. Instructional objectives
   b. Diagnostic instruments
   c. Materials and equipment
   d. Learning settings
   e. Teaching methods
   f. Instructional times

OVERVIEW OF INDIVIDUALIZED INSTRUCTION

The central question of concern to teachers is how to meet the needs of the individual student in a school system geared to educate the masses through group instruction. Teachers generally have handled the response to this question by thinking about individualized instruction in terms of instruction for a few students whose learning needs are so different that they demand special attention. Students requiring remedial work that cannot be handled by group instruction are tutored by the teacher. Very bright students are singled out for independent work called "enrichment". In this way the teacher handles the extremes in the class with the purpose of bringing them to the point where they can rejoin the group. Essentially by making individual arrangements for these students, the teacher works towards minimizing their individual differences so that they are more manageable in group instruction.

This appears to be a contradictory way of thinking about individualizing instruction. However, a teacher has no choice in the face of persistent demands to individualize teaching in a system designed for and geared to group instruction. As a result, the teacher is forced to limit individualized instruction to the few students who can be handled through tutoring or independent study.

However, individualized instruction as a way of teaching requires that each individual student, rather than the group, be the starting point for all instructional decisions. This is the only restriction in the definition. The teacher is free to use any materials, groupings, teaching methods, etc. needed to carry out these instructional decisions.

The following statements present a set of typical classroom practices which describe instances of individualized or group instruction. Using the criterion that individualized instruction requires that the learning needs of the individual student form the basis for all instructional decisions, you are asked to decide which statements describe individualized instruction and which describe group instruction. You will need a 5 x 8 card to uncover the answers and explanations for each item.

THE FOLLOWING PRACTICE MATERIALS AND EXERCISES ARE SELF-CORRECTING. SLIDE A 5 X 8 CARD DOWN THE PAGE UNTIL YOU SEE A ROW OF DOTS.

....

THEN STOP. READ THE STATEMENT AND CHECK THE COLUMN ON THE RIGHT WHICH INDICATES WHETHER OR NOT THE STATEMENT DESCRIBES INDIVIDUALIZED INSTRUCTION OR GROUP INSTRUCTION. SLIDE THE CARD DOWN UNTIL YOU SEE A ROW OF ASTERISKS.

****

THEN STOP. READ THE SUGGESTED ANSWER. CONTINUE THE PROCEDURE UNCOVERING EACH STATEMENT AND THEN THE SUGGESTED ANSWER.

EXERCISE

		Check One	
		Ind.	Group
1.	a. Administers informal reading inventory to each student.		
	b. Organizes class into high, average and low reading groups based on inventory scores.		
	c. Assigns a different basal reader to each group.		
	....		
	a. The teacher is measuring the learning needs of individual students in reading.	✓	
	b. By organizing students into groups, the teacher is orienting her teaching toward group instruction.		✓
	c. By assigning a text to each group the teacher is orienting her teaching toward group instruction.		✓
	**		

Check One

	Ind.	Group
2. a. Analyzes difficulty a student is having with addition and subtraction facts up to ten.		
b. Gives student homework assignment consisting of arithmetic worksheets (facts 1-10) and counting rods.		
....		
a. The teacher is diagnosing an individual student's learning problem.	✓	
b. The teacher is assigning materials for an individual student's learning need.	✓	
**		
3. Decides to put the class through a systematic review of all the science assigned to the previous grade.		
....		
This activity assumes all the students have learned and forgotten the same things. It also requires all students to work through the review at the same rate.		✓
**		
4. Recommends highly-talented student for piano lessons in lieu of scheduled music class.		
....		
The teacher is providing the student with music instruction suited to his particular talent.	✓	
**		
5. a. Identifies five students having repeated difficulties with addition in solving two-step problems.		
b. Administers test on additon facts to five students. Two pass (100%, 95%); three fail (25%, 70%, 75%).		
c. Decides the 70% and 75% students need additional drill and assigns them to drill each other with flash cards.		
d. Assigns the 25% student to supplementary worksheets and disks; checks on him freqently.		
e. Scolds the two remaining students for being careless in solving two-step problems.		

	Check One	
	Ind.	Group
a. The teacher is singling out individual students for further attention.	✓	
b. The teacher is measuring the achievement of the individual student.	✓	
c. In this case, the 70 & 75% students' individual learning needs are identical and can be met in a group activity.	✓	
d. The 25% student is assigned an activity and materials suited to his learning need.	✓	
e. The teacher has eliminated the possibility of poor recall of addition facts in the case of these two students. However, their individual learning problems are still undiagnosed. The teacher assumes both are careless.		✓
** 6. Tutors a student during a snack time so he can catch up to the class in spelling.		
.... This is a tricky statement. It is true that the teacher is working intensively on a student's individual learning needs. However, she wants to fit him back into a system of group instruction. Employing an occasional individualized technique to facilitate group instruction cannot be considered individualized instruction.		✓

END OF EXERCISE

Once the teacher decides that the individual student and what he needs to learn are the basis for all instructional decisions, the teacher has taken the first step in individualizing instruction. The next step includes organizing all the instructional resources available to the teacher into a system that creates a learning environment suited to the individual learner. The instructional resources needed are:

1. Instructional Objectives: A description of the intended outcomes of instruction. It may be expressed as a very broad, general goal, a more specific goal or a very specific description of student behavior. Depending upon its degree of specificity, it may be called a goal, aim, purpose, objective (instructional or behavioral), skills, etc.
2. Diagnostic Instruments: Testing devices and assessment procedures used to gather data on student behavior in terms of learning needs and characteristics.
3. Materials and Equipment: All printed materials, audio-visual aids, mechanical devices, laboratory supplies, and objects that contain or convey information in an instructional program.
4. Teaching Methods: Specific procedures for guiding a student in learning a new behavior. The method, selected by the teacher, may or may not require the teacher's direct supervision as in the use of small group discussion or self-instructing materials.
5. Learning settings: Arrangements or groupings of students ranging from one student to large group instruction with or without the direct involvement of the teacher. The groups are formed on the basis of individual needs and are not permanent

6. Instructional time: The amount of time a student spends in a subject area (flexible scheduling) or on a particular learning goal (pacing).

All the objects, devices, physical facilities and arrangements described above are instructional resources familiar to teachers and students in any instructional program. However, in individualized instruction the teacher and student use these resources in special ways. The teacher creates a unique program of studies for the individual student by choosing a specific instructional objective to be mastered by the student and deliberately selecting those instructional resources that will help him master the objective. The student works on his program under the teacher's guidance. How the student behaves while working in the program tells the teacher what he still needs to learn, what he has learned and how he reacts as a learner to the program created for him. This relationship between the teacher and student is shown in Figure 1.

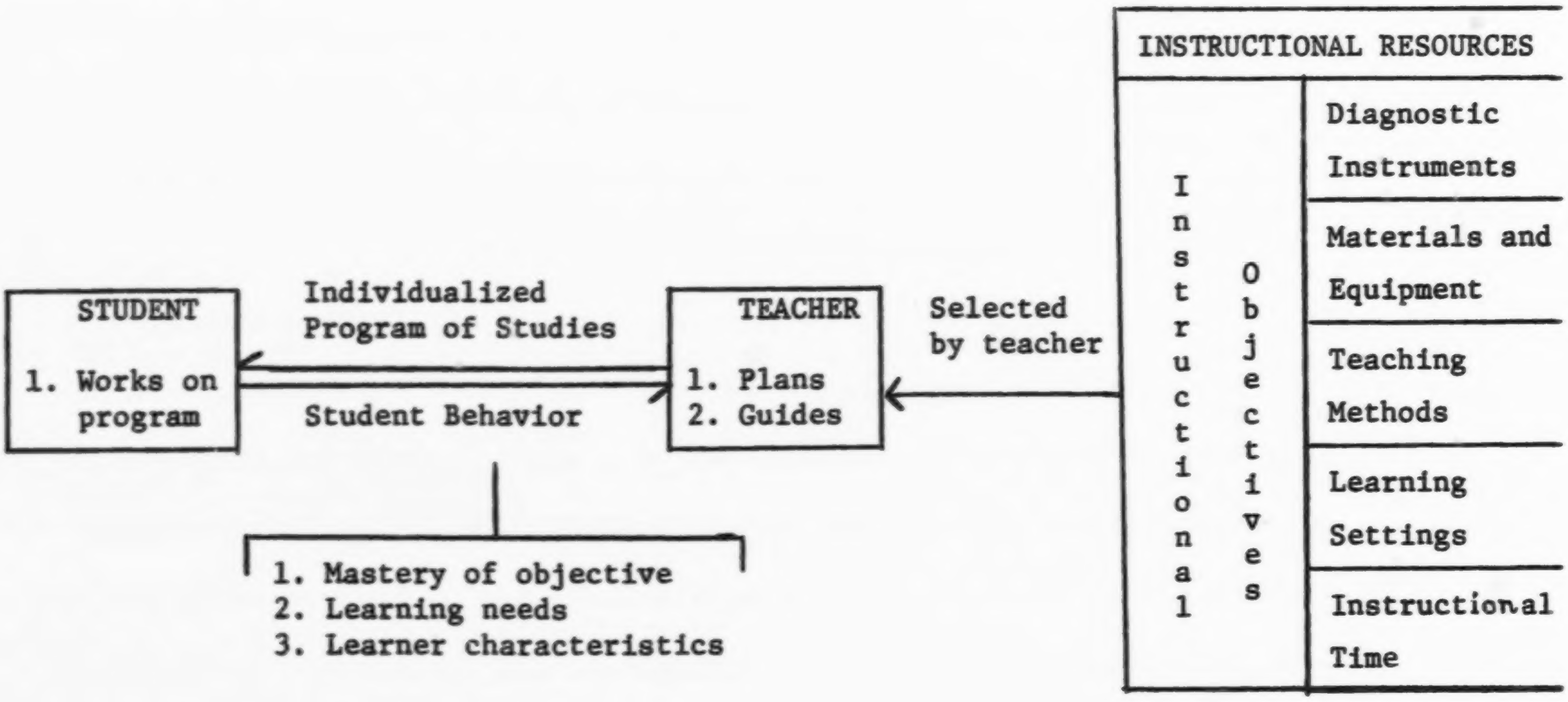

STUDENT
1. Works on program
Individualized Program of Studies
Student Behavior
1. Mastery of objective
2. Learning needs
3. Learner characteristics
TEACHER
1. Plans
2. Guides
Selected by teacher
INSTRUCTIONAL RESOURCES
Instructional Objectives
Diagnostic Instruments
Materials and Equipment
Teaching Methods
Learning Settings
Instructional Time

Figure 1 represents a system of individualized instruction in which a teacher plans an individualized program of studies for a student by selecting appropriate resources from a larger set of instructional resources. The teacher guides the student as he works through the program. The student's behavior in the program in turn tells the teacher about his:

1. Mastery of the objective: Minimum acceptable performance of the stated objective.
2. Learning needs: A behavior or part of a behavior that a student must master. What exactly the student needs to learn in relation to a particular learning goal.
3. Learner characteristics: A set of student behaviors which can facilitate or impede his learning something new. Such things as organic development and peer-group relations affect the student's learning process and are characteristic of how he performs in school.

Based on this information, the teacher continues to develop the student's program of studies based on individual needs and characteristics.

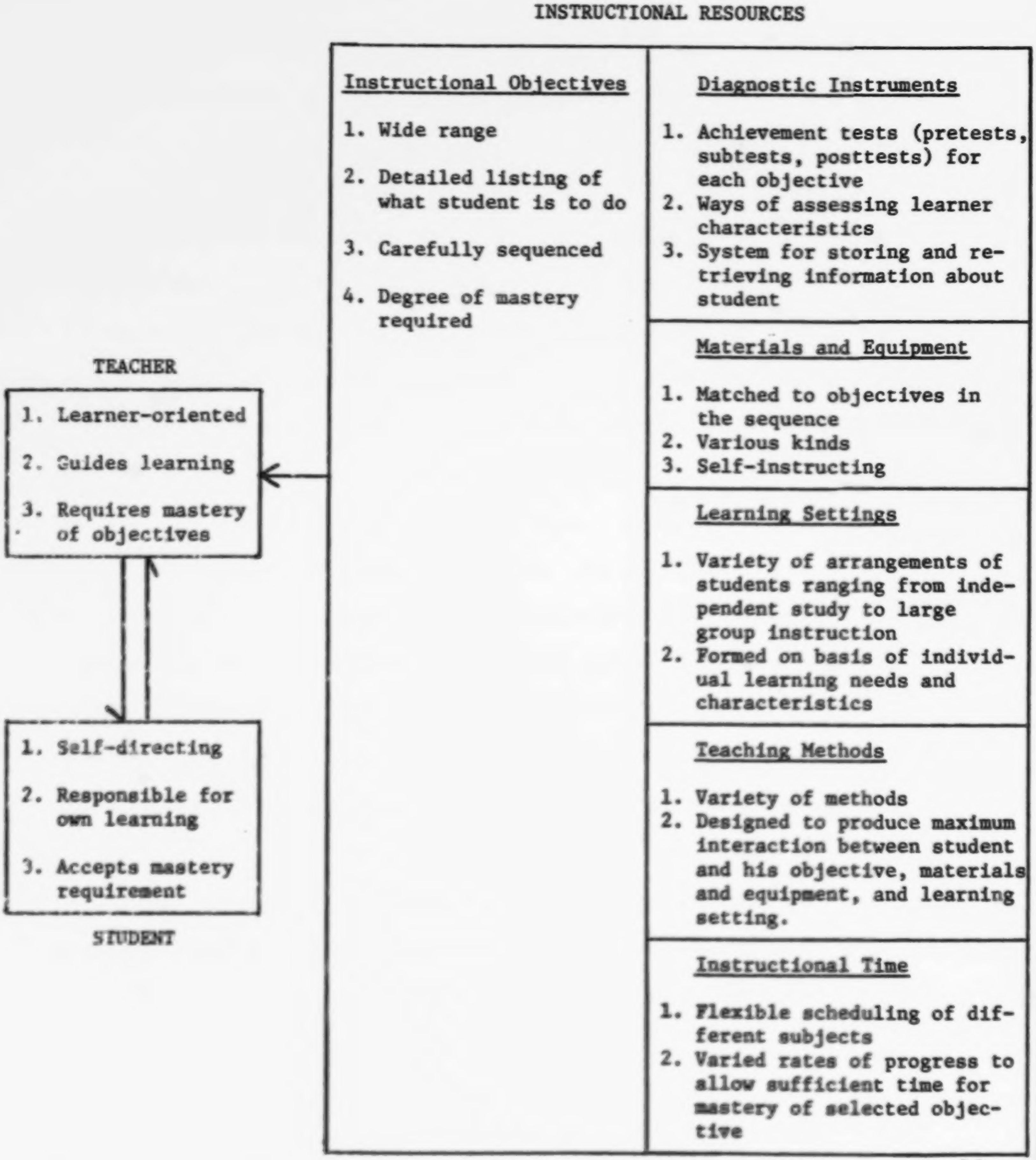
This brief description is familiar to teachers who have time and time again attempted and failed to individualize instruction for all students in a system geared to group instruction.

In order for a teacher to manage individualized instruction for every student in the class, the teacher-student working relationship and the instructional resources they will use must have special characteristics that help the teacher individualize instruction. Generally speaking, the teacher must be flexible and ready to adapt instruction to any individual learning need encountered in the classroom. Instructional resources must offer the teacher a wide range of choices and a variety of selections for individualizing the instruction of each student. The students themselves must work differently in such a program and interact in special ways with the teacher.

Figure 2 expands the description of the system of individualized instruction presented in Figure 1. Figure 2 adds the special characteristics that distinguish a system of individualized instruction from more conventional systems. Examine Figure 2 carefully in preparation for a small group discussion. The discussion will give you an opportunity to exchange ideas and information with some of the other teachers working through these materials. This exchange might include:

1. Any questions or topics you would like to discuss.
2. A discussion on the complementary roles of the teacher and student in individualized instruction.
3. A discussion on how the special characteristics of the instructional resources can help a teacher to individualize instruction. (You may wish to select one or two resources for detailed discussion or one characteristic of each resource for a broader discussion.)
4. Describe how you have individualized instruction by specifying how you worked with the student and what instructional resources you used.

Figure 2: Special Characteristics of a System of Individualized Instruction



INSTRUCTIONAL RESOURCES

Instructional Objectives

1. Wide range
2. Detailed listing of what student is to do
3. Carefully sequenced
4. Degree of mastery required

Diagnostic Instruments

1. Achievement tests (pretests, subtests, posttests) for each objective
2. Ways of assessing learner characteristics
3. System for storing and retrieving information about student

Materials and Equipment

1. Matched to objectives in the sequence
2. Various kinds
3. Self-instructing

Learning Settings

1. Variety of arrangements of students ranging from independent study to large group instruction
2. Formed on basis of individual learning needs and characteristics

Teaching Methods

1. Variety of methods
2. Designed to produce maximum interaction between student and his objective, materials and equipment, and learning setting.

Instructional Time

1. Flexible scheduling of different subjects
2. Varied rates of progress to allow sufficient time for mastery of selected objective

TEACHER

1. Learner-oriented
2. Guides learning
3. Requires mastery of objectives

STUDENT

1. Self-directing
2. Responsible for own learning
3. Accepts mastery requirement

SMALL GROUP DISCUSSION

The Special Characteristics of a System of Individualized Instruction

1. Either start a sign-up sheet to form a small group of about six (6) teachers or add your name to one.
2. Participate in the group discussion as suggested as soon as a group of about six (6) teachers is formed. In the event you must wait for a group to form, continue working through these materials until a group is ready.
3. Use the rest of the page for any notes you may wish to make during the discussion.

POSTTEST: Section I: Overview of Individualized Instruction

The following items constitute a posttest.

The answer key which accompanies the test is correlated to the instruction materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Use the directions given with the pretest.

Answer true or false:

1. In individualized instruction, a teacher provides for individual differences in order to bring the students to the point where they are more manageable in group discussion. __________

2. Individualized instruction uses the tutorial method almost exclusively. __________

3. Teacher works after school with a student in addition so he can keep up in class the next day. This is an example of group instruction. __________

4. Teacher gives a student a number line to help him with his difficulty in remembering number facts. This is an example of individualized instruction. __________

5. Two students work on an identical multiplication problem of the type both had failed on a diagnostic test. This is an example of group instruction. __________

6. A system of individualized instruction encourages the teacher to use a wide range and variety of materials. __________

7. Tutoring is the method most frequently used by teachers to individualize instruction. __________

8. Individual rates of progress allow each student to master his instructional objective. __________

9. In selecting materials and equipment the teacher chooses those items that are matched to the students instructional objective. ______

10. Both student and teacher work toward mastery of the instructional objective. ______

Complete:

1. A teacher plans a individualized program for a student based upon information about the student's:

   a. ______________________

   b. ______________________

   c. ______________________

2. The six kinds of instructional resources used by a teacher to individualize instruction are:

   a. ______________________

   b. ______________________

   c. ______________________

   d. ______________________

   e. ______________________

   f. ______________________

ANSWER KEY

POSTTEST: Section I: Overview of Individualized Instruction (pp. ~~[illegible]~~ 18-28)

True-False:

1. F
2. F
3. T
4. T
5. F
6. T
7. F
8. T
9. T
10. T

Completion:

1. a. Mastery of instructional objective
   b. Learning needs
   c. Learner characteristics

2. a. Instructional objectives
   b. Diagnostic instruments
   c. Materials and equipment
   d. Learning settings
   e. Teaching methods
   f. Instructional times

HOW INSTRUCTION IS INDIVIDUALIZED

HOW INSTRUCTION IS INDIVIDUALIZED

The teacher:

1. Describes how instruction is individualized:
   a. Names the component of instruction that is varied to individualize instruction.
   b. Lists and describes the six instructional resources that may be varied from student to student.
   c. Identifies instances of individualized instruction and the specific instructional resources being used to vary instruction.

2. Describes the steps taken in individualizing instruction:
   a. Names in order and explains each of the steps.
   b. Identifies the instructional resources and names the step in which they are used.
   c. Describes mastery requirement as a prerequisite to proceeding to next goal.

PRETEST: Section I: How Instruction is Individualized

The following items constitute a pretest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Directions:

1. Take the pretest.
2. Use the answer key immediately following the pretest to correct your work.
3. Work on the pages to which you are directed by the pretest answer key.
4. Take the posttest.
5. Use the answer key immediately following the posttest to correct your work.
6. Move on to the next pretest if you have scored 100%.
7. Work on the pages to which you are directed by the posttest answer key if you have scored under 100%. Discuss these pages with other teachers working through this section.
8. Use the pretest as a posttest. (Alternate using the two test forms.)
9. Work toward 100% mastery.

Select the instructional resource being varied in each statement. Write the letter of the correct answer in the blank on the right.

1. Two students are learning to read maps. One is working with programmed instruction while the other is watching a film on maps (a) diagnostic instruments (b) instructional settings (c) instructional material ________

2. The teacher gives a lecture-demonstration to a group of students studying underwater life. (a) instructional time (b) instructional objectives (c) teaching method ________

3. A student moving very rapidly through the math program is allowed to proceed unhindered. (a) instructional setting (b) instructional time (c) diagnostic instrument ________

4. High school students are permitted to learn a foreign language of their choice. (a) instructional objectives (b) instructional method (c) instructional setting ________

Select the step or steps taken in individualized instruction being described in each statement. Write the letter of the correct answer in the blank on the right.

5. Student works on program while teacher gives him guidance.
    (a) Implementing program
    (b) Mastery testing
    (c) Diagnosis of learning needs ________

6. Teacher diagnoses student progress and modifies student's program as needed.
    (a) Diagnosis of learning needs
    (b) Ongoing evaluation
    (c) Prescription of learning program ________

7. Teacher varies materials and equipment.
    (a) Selection of instructional objective
    (b) Prescription of learning program
    (c) Ongoing evaluation ________

8. Teacher varies teaching methods.
    (a) Prescription of learning Program
    (b) Mastery testing
    (c) Ongoing evaluation ________

ANSWER KEY

PRETEST: Section I: How Instruction is Individualized (pp. 39-47)

1. c
2. b,c
3. b
4. a
5. a
6. b
7. b
8. a

HOW INSTRUCTION IS INDIVIDUALIZED

In individualizing instruction, the teacher starts with a particular student in mind and builds a learning program for him. In a class where instruction is individualized for all students, each student's program will differ from the others in one or more of the instructional resources assigned by the teacher. The teacher individualizes instruction by varying the instructional resources used from student to student according to each students individual needs.

In such a class, we will find students working towards mastery of different instructional objectives. The teacher will be using different diagnostic instruments for different students. The materials and equipment used will differ from student to student. Students will be working in different learning settings and different teaching methods will be used by the teacher. In addition, different students will spend different amounts of time on a subject and work towards mastery of an objective at different rates.

The following statements are examples of how students' individual learning programs differ from one another in one or more of the following instructional resources:

1. Instructional objectives
2. Diagnostic instruments
3. Materials and equipment
4. Learning settings
5. Teaching methods
6. Instructional time

USE THE 5 X 8 CARD TO UNCOVER THE STATEMENTS. FILL IN THE BLANKS AT THE END OF EACH STATEMENT WITH AN APPROPRIATE NUMBER FROM THE LIST AVOVE TO INDICATE THE INSTRUCTION RESOURCE (S) BEING VARIED.

EXERCISE

1. High school students are permitted to learn a foreign language of their choice. __________

....

(1) Instructional objectives are varied by permitting different students to work in different subject areas.

****

2. Two students are learning to read maps. One is learning this with programmed instruction while the other learns map reading by watching a film. __________

....

(3) Different materials are used for different students working on the same instructional objective.

****

3. A student is given as much time as he needs to complete the assignment. __________

....

(6) Different students are paced through the curriculum at different rates.

****

4. The teacher gives a lecture-demonstration to a group of students studying underwater life as a special topic. __________

....

(4 & 5) Instructional objectives (study of underwater life) are different for this group of students and the teacher is employing a particular teaching method with them.

****

5. Students are given a spelling pretest. ________

....

(2) A diagnostic instrument is used to discover students' achievement in spelling before it is taught.

****

6. A few bright students begin independent study of marine biology. _____

....

(1 & 4) Instructional objectives (marine biology) and a particular learning setting are selected based on students' abilities.

****

7. The teacher uses the questioning technique to get a quiet student to respond. ________

....

(5) Teacher is selecting a teaching method for a student with a particular characteristic.

****

8. In a unit of Canada different students are required to do particular kinds of reporting on various aspects of the country. ________

....

(1) Instructional objectives are being differentiated in terms of the kinds of reporting students do and the subject matter they cover.

****

9. A teacher uses a checklist to record her observations of some students reading orally. ________

....

(2) Diagnostic instrument is used to record student behavior.

****

10. A student moving very rapidly through the math program is allowed to proceed unhindered. ________

....

(6) Individual student is allowed to work at his own rate of progress.

****

11. Students have been assigned multi-level texts in science to match their reading levels. ________

....

(3) Material is chosed based on students' reading abilities.

****

12. A student learning to plot simple line graphs is given graph paper, pencils and rulers. ________

....

(3) Materials are selected for facilitating the learning of a skill by an individual student.

****

13. A teacher assignes students to pupil-teams, peer-tutoring and small group instruction in running her spelling program. ________

....

(4) Learning settings are varied in carrying out the program.

****

14. Teacher-pupil planning is found to be a successful way in developing a new topic in Civics. ________

....

(5) Teaching method is used to develop lesson.

****

15. Sometimes students are taught in a whole class or in a large group of more than one class. ________

....

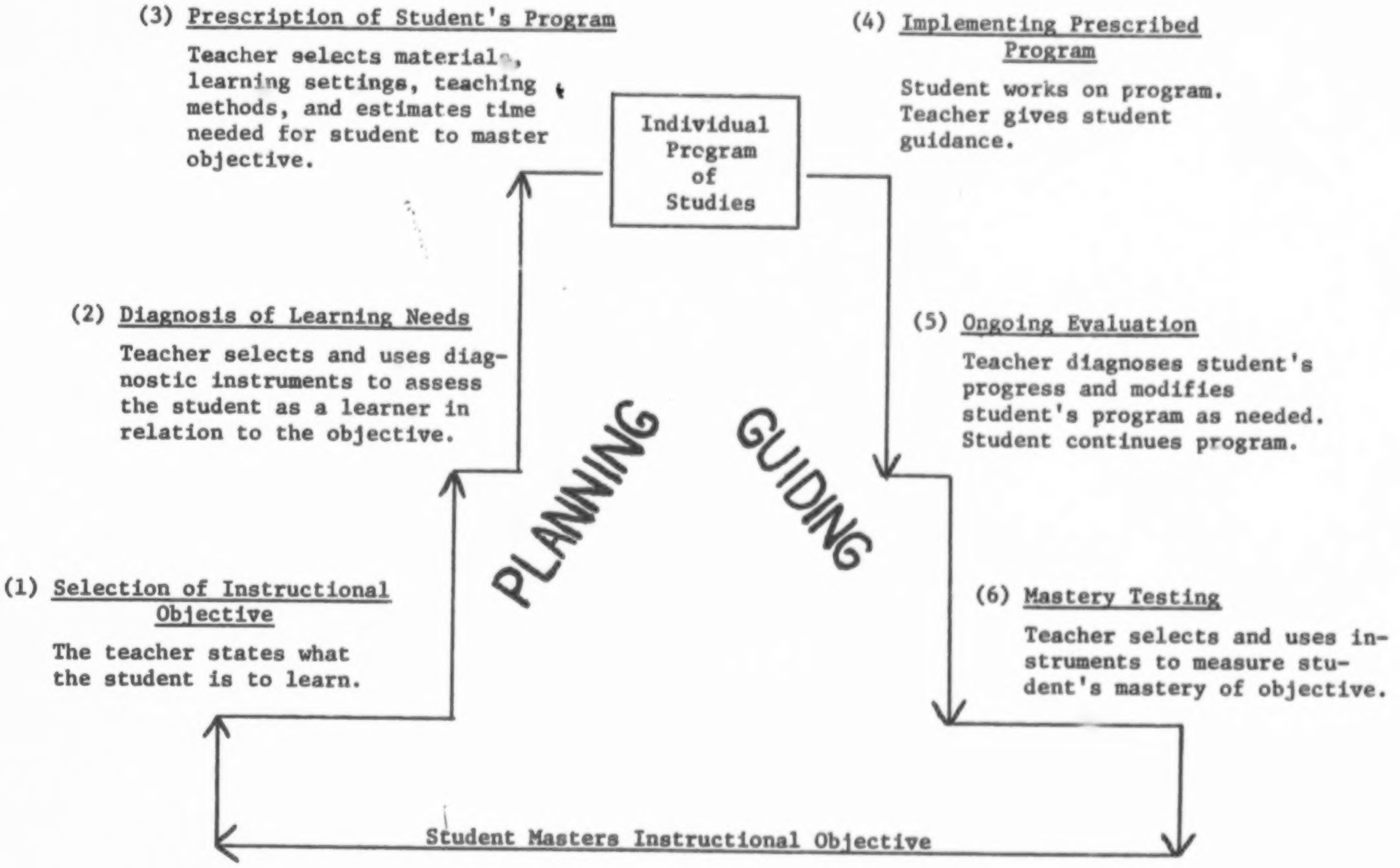
(4) Learning setting is varied at different times.

****

END OF EXERCISE

In creating an individual program of studies for a student, the teacher proceeds systematically in selecting and assigning the appropriate instructional resources. The steps that are followed are represented in Figure 3 and are explained below.

Figure 3: Steps in Individualizing Instruction



(1) Selection of Instructional Objective

The teacher states what the student is to learn.

(2) Diagnosis of Learning Needs

Teacher selects and uses diagnostic instruments to assess the student as a learner in relation to the objective.

(3) Prescription of Student's Program

Teacher selects materials, learning settings, teaching methods, and estimates time needed for student to master objective.

(4) Implementing Prescribed Program

Student works on program. Teacher gives student guidance.

(5) Ongoing Evaluation

Teacher diagnoses student's progress and modifies student's program as needed. Student continues program.

(6) Mastery Testing

Teacher selects and uses instruments to measure student's mastery of objective.

Individual Program of Studies
PLANNING
GUIDING
Student Masters Instructional Objective

Step 1. Selection of Instructional Objective

The teacher begins planning by stating the instructional objective selected for the student. The objective may be the acquisition of a mathematics skill, the mastery of a set of scientific facts, the development of a social skill, etc. Whatever the objective may be, it is selected on the basis of what the student needs to learn next.

Step 2. Diagnosis of Learning Needs

Before instruction begins, the teacher pretests the student on the objective to determine what he knows and does not know. In addition, the teacher gathers relevant information about the student's past performance and background. This gives the teacher a set of data upon which to build the student's program. These data are obtained from pencil and paper tests, performance tests, checklists, informal inventories, standardized tests, cumulative records, etc.

Step 3. Prescription of Student's Program

This is the last phase of pre-instructional planning. The teacher reviews all the instructional resources available and prescribes the resources that will help the student master the instructional objective. At the end of this step, the initial design of an individual program of studies for the student is completed.

Step 4. Implementing Prescribed Program

At this point, both teacher and student carry out the program of studies as designed. The student uses the prescribed instructional resources and works towards mastery of the objective while the teacher guides him in following the program. This step is concerned with implementing the program as initially conceived by the teacher and is very closely related to Step 5.

Step 5. Ongoing Evaluation

As the student is working through his program of studies, his performance provides the teacher with data about its effectiveness. The teacher uses work products and the behaviors that the student exhibits as he works in the program as additional diagnostic data. These data tell the teacher whether or not the student is making progress towards mastery, and suggest reasons for progress or lack of progress. Based on this, the teacher may modify the student's program by repeating some or all of the pre-instructional activities of Steps 2 and 3 (Diagnosis and Prescription). The cycle of ongoing evaluation, re-diagnosis, re-prescription, and implementation is continued until the teacher judges the student is ready to be tested for mastery of the objective.

Step 6. Mastery Testing

Once the teacher has concrete evidence from the ongoing evaluation that the student has mastered his instructional objective and she can predict a high probability of success on a mastery test, the teacher selects an appropriate mastery test and assigns it to the student.

If the student's test performance indicates mastery of the objective, he is recycled to start a new program of studies. The teacher starts with Step 1 again. In the event the student does not meet the mastery criterion, his test performance is used as additional diagnostic data and the teacher recycles his program through all or part of Steps 2, 3, 4 and 5.

SMALL GROUP DISCUSSION

Steps in Individualizing Instruction

Preparation:

1. Select a student currently or recently enrolled in your class.
2. Plan and describe briefly an individual program of studies for this student by following the Steps 1 - 3 in individualizing instruction outlined on the preceding pages. (It will be necessary to simulate data in Step 2).
   Assume that all the instructional resources you need are available.
3. Either start a sign-up sheet to form a small group of about 4 - 6 teachers or add your name to one.
4. Join the group when it is formed.

Discussion:

1. Present and discuss the program created by the teachers in the group.
2. Project how the student would work in Steps 4 - 6 and describe some of the modifications you would make.
3. Include any questions or topics on individualizing instruction you may wish to discuss.

Up to this point, individualized instruction has been presented as an instructional system designed to create a learning environment suited to the individual learner's needs and characteristics. The discussion has described the framework within which a teacher can individualize instruction and has outlined the steps to be taken.

As important as the orientation to individualized instruction is, it falls far short of what the classroom teacher needs to individualize instruction for all the students in her classroom. The teacher needs a complete set of fully-developed instructional resources to individualize instruction.

At the present time, Individually Prescribed Instruction (IPI) provides the teacher with a specific system of individualized instruction that can help to increase the individualization of instruction for all students. The materials that follow will describe IPI as a specific system of individualized instruction.

POSTTEST: Section I: How Instruction is Individualized

The following items constitute a posttest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Use the directions given with the pretest.

Select the instructional resource being varied in each statement. Write the letter of the correct answer in the blank on the right.

1. Two students are learning to read maps. One is working with programmed instruction while the other is watching a film on maps (a) diagnostic instruments (b) instructional settings (c) instructional material ________

2. The teacher gives a lecture-demonstration to a group of students studying underwater life. (a) instructional time (b) instructional objectives (c) teaching method ________

3. A student moving very rapidly through the math program is allowed to proceed unhindered. (a) instructional setting (b) instructional time (c) diagnostic instrument ________

4. High school students are permitted to learn a foreign language of their choice. (a) instructional objectives (b) instructional method (c) instructional setting ________

Select the step or steps taken in individualized instruction being described in each statement. Write the letter of the correct answer in the blank on the right.

5. Student works on program while teacher gives him guidance.
    (a) Implementing program
    (b) Mastery testing
    (c) Diagnosis of learning needs ________

6. Teacher diagnoses student progress and modifies student's program as needed.
    (a) Diagnosis of learning needs
    (b) Ongoing evaluation
    (c) Prescription of learning program ________

7. Teacher varies materials and equipment.
    (a) Selection of instructional objective
    (b) Prescription of learning program
    (c) Ongoing evaluation ________

8. Teacher varies teaching methods.
    (a) Prescription of learning Program
    (b) Mastery testing
    (c) Ongoing evaluation ________

J

ANSWER KEY

POSTTEST: Section I: How Instruction is Individualized (pp. 39-47 ~~[illegible]~~)

1. c
2. b,c
3. b
4. a
5. a
6. b
7. b
8. a

OVERVIEW OF IPI

OVERVIEW OF IPI

The teacher defines IPI as a specific system of individualized instruction:

a. Names the major components and explains how they work together.

b. Discriminates between instances of individualized instuction using IPI resources and non-IPI resources.

c. Describes the required characteristics of each component.

PRETEST: Section I: Overview of IPI

The following items constitute a pretest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Directions:

1. Take the pretest.
2. Use the answer key immediately following the pretest to correct your work.
3. Work on the pages to which you are directed by the pretest answer key.
4. Take the posttest.
5. Use the answer key immediately following the posttest to correct your work.
6. Move on to the next pretest if you have scored 100%.
7. Work on the pages to which you are directed by the posttest answer key if you have scored under 100%. Discuss these pages with other teachers working through this section.
8. Use the pretest as a posttest. (Alternate using the two test forms.)
9. Work toward 100% mastery.

Complete:

1. The two types of diagnostic instruments specified by the IPI system are:
(a)____________________
(b)____________________

2. The aide in IPI carries out three main functions. These are:
(a)____________________
(b)____________________
(c)____________________

3. Two resources in IPI are not specified. These are:
(a)____________________
(b)____________________

4. Instructional objectives in IPI are specified as:
(a)____________________

5. In IPI, a student works on his:
(a)____________________

6. In IPI, instructional time is specified as:
(a)____________________

7. The material most used in IPI consists of:
(a)____________________

8. Individually Prescribed Instruction is a ________ system of individualized instruction.
(a)____________________

9. In IPI, skill objectives are correlated with:
(a)____________________
(b)____________________

10. As in the generalized program of individualized instruction, in IPI each student is provided with a program suited to his:
(a)____________________
(b)____________________

Answer true or false:

1. An IPI teacher constructs her own pretests. __________

2. An IPI teacher uses materials correlated with behavioral objectives. __________

3. Student in IPI spends different amounts of time working on mathematics each day. __________

4. Student in IPI must complete math prescription at end of each math class. __________

ANSWER KEY

58-64

PRETEST: Section I: Overview of IPI (pp. ~~[illegible]~~)

Completion:

1. a. IPI achievement tests
   b. IPI record system

2. a. scores work
   b. maintains record system
   c. maintains materials center

3. a. teaching techniques
   b. instructional time

4. math skill objectives

5. individual prescription

6. pacing

7. skill worksheets

8. specific

9. a. diagnostic instruments
   b. skill worksheets

10. a. learning needs
    b. characteristics

True-False:

1. F

2. T

3. F

4. F

Audio Tape #1: Dr. Robert Scanlon, The History of IPI. Research for Better Schools, Inc. (Philadelphia, Pa.) 1967.

DIRECTIONS: Listen to Audio-Tape #1. You may do this at any point of your work in this section.

Individually Prescribed Instruction is a specific system of individualized instruction. In IPI, teachers use a set of behavioral objectives correlated with diagnostic instruments and curriculum materials, teaching techniques and instructional time that are designed:

1. To enable each pupil to work at his own rate through units of study in a learning sequence.
2. To develop in each pupil a demonstrable degree of mastery.
3. To develop self-initiation and self-direction of learning.
4. To foster the development of problem-solving though processes.
5. To encourage self-evaluation and motivation for learning.

IPI as a specific system of individualized instruction is very similar to our general model of individualized instruction (Figure 1). Figure 4 represents a system of IPI with its special vocabulary and resources engineered for IPI. Study Figure 4 carefully to learn about IPI vocabulary and IPI resources.

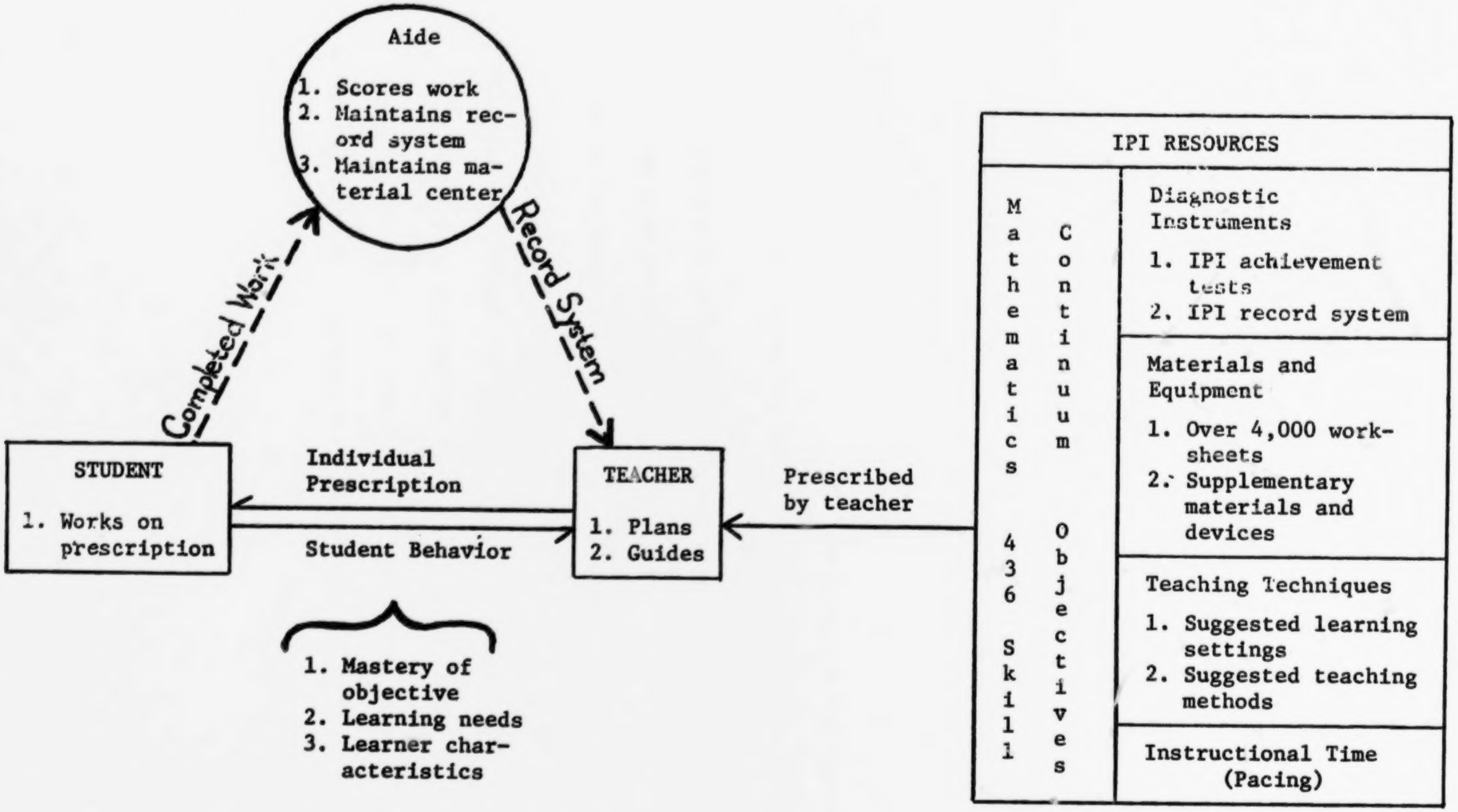

Aide
1. Scores work
2. Maintains record system
3. Maintains material center
Completed Work
Record System
STUDENT
1. Works on prescription
Individual Prescription
Student Behavior
TEACHER
1. Plans
2. Guides
1. Mastery of objective
2. Learning needs
3. Learner characteristics
Prescribed by teacher
IPI RESOURCES
Mathematics Continuum
436 Skill Objectives
Diagnostic Instruments
1. IPI achievement tests
2. IPI record system
Materials and Equipment
1. Over 4,000 worksheets
2. Supplementary materials and devices
Teaching Techniques
1. Suggested learning settings
2. Suggested teaching methods
Instructional Time (Pacing)

Figure 4: The System of Individually Prescribed Instruction

EXERCISE

Compare Figure 4 The System of Individually Prescribed Instruction to Figure 2: A System of Individualized Instruction to note their similarities and differences.

There are six elements which distinguish Individually Prescribed Instruction from conventional elementary school procedures:

First : *detailed specifications of educational objectives*;

Second : *organization of methods and materials to attain these objectives*;

Third : *careful determination of each pupil's present competence in a given subject*;

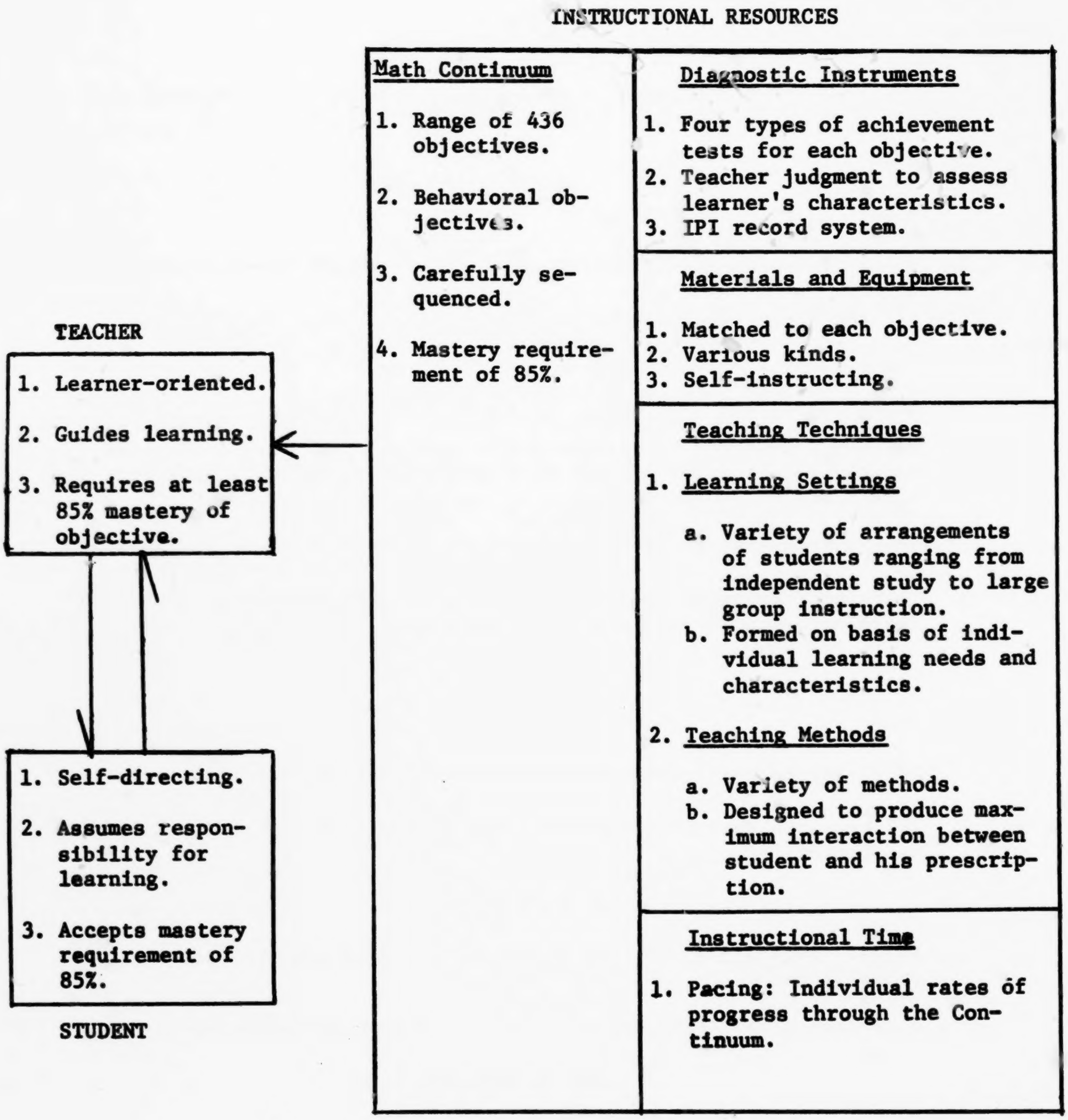
Fourth : *individual daily evaluation and guidance of each pupil*;

Fifth : *provision for frequent monitoring of student performance, in order to inform both the pupil and the teacher of progress toward an objective*;

Sixth : *continual evaluation and strengthening of the curriculum and instructional procedures*.

They are represented in Figure 5 which expands the description of IPI to include its special characteristics. Figure 5 is similar to Figure 2. Use the following exercise to help you compare them.

Figure 5: Special Characteristics of IPI



INSTRUCTIONAL RESOURCES

Math Continuum

1. Range of 436 objectives.
2. Behavioral objectives.
3. Carefully sequenced.
4. Mastery requirement of 85%.

Diagnostic Instruments

1. Four types of achievement tests for each objective.
2. Teacher judgment to assess learner's characteristics.
3. IPI record system.

Materials and Equipment

1. Matched to each objective.
2. Various kinds.
3. Self-instructing.

Teaching Techniques

1. Learning Settings
   a. Variety of arrangements of students ranging from independent study to large group instruction.
   b. Formed on basis of individual learning needs and characteristics.
2. Teaching Methods
   a. Variety of methods.
   b. Designed to produce maximum interaction between student and his prescription.

Instructional Time

1. Pacing: Individual rates of progress through the Continuum.

TEACHER

1. Learner-oriented.
2. Guides learning.
3. Requires at least 85% mastery of objective.

STUDENT

1. Self-directing.
2. Assumes responsibility for learning.
3. Accepts mastery requirement of 85%.

THE FOLLOWING STATEMENTS WILL HELP YOU COMPARE FIGURES 2 and 5 AND SPECIFY HOW IPI HAS BEEN ENGINEERED TO INDIVIDUALIZE INSTRUCTION. USE THE 5 X 8 CARD TO UNCOVER THE ITEMS. ANSWER BY FILLING IN TRUE OR FALSE.

EXERCISE

1. Of the three major parts of each figure, the student component and the teacher component are identical in both Figures 2 & 5. ________

....

True. Check Figures 2 and 5.

****

2. All the basic requirements for instructional objectives have not been met by the IPI Mathematics Continuum. ________

....

False. Inspection of Figures 2 & 5 indicates that the IPI Mathematics Continuum has met all four basic requirements for instructional objectives.

****

3. Teaching techniques used in IPI meet all basic requirements for learning settings and methods set in Figure 2. ________

....

True.

****

4. IPI requires that instructional time allow for flexible scheduling and pacing. ________

....

False. Figure 5 shows that pacing is the only way IPI uses instructional time.

****

END OF EXERCISE

POSTTEST: Section I: Overview of IPI

The following items constitute a posttest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Use the directions given with the pretest.

Complete:

1. The two types of diagnostic instruments specified by the IPI system are:

(a)____________________

(b)____________________

2. The aide in IPI carries out three main functions. These are:

(a)____________________

(b)____________________

(c)____________________

3. Two resources in IPI are not specified. These are:

(a)____________________

(b)____________________

4. Instructional objectives in IPI are specified as:

(a)____________________

5. In IPI, a student works on his:

(a)____________________

6. In IPI, instructional time is specified as:

(a)____________________

7. The material most used in IPI consists of:

(a)____________________

8. Individually Prescribed Instruction is a __________ system of individualized instruction.

(a)____________________

9. In IPI, skill objectives are correlated with:

(a)____________________

(b)____________________

10. As in the generalized program of individualized instruction, in IPI each student is provided with a program suited to his:

(a)____________________

(b)____________________

Answer true or false:

1. An IPI teacher constructs her own pretests. __________

2. An IPI teacher uses materials correlated with behavior objectives. __________

3. Student in IPI spends different amounts of time working on mathematics each day. __________

4. Student in IPI must complete math prescription at end of each math class. __________

ANSWER KEY

POSTTEST: Section I: Overview of IPI (pp. 58-64

Completion:

1. a. IPI achievement tests
   b. IPI record system

2. a. scores work
   b. maintains record system
   c. maintains materials center

3. a. teaching techniques
   b. instructional time

4. math skill objectives

5. individual prescription

6. pacing

7. skill worksheets

8. specific

9. a. diagnostic instruments
   b. skill worksheets

10. a. learning needs
    b. characteristics

True-False:

1. F

2. T

3. F

4. F

HOW INSTRUCTION IS INDIVIDUALIZED IN IPI

HOW INSTRUCTION IS INDIVIDUALIZED IN IPI

The teacher:

1. Describes how instruction is individualized in IPI:
    a. Names the IPI component of the system that is varied.
    b. Lists and describes the 5 instructional resources that may be varied from student to student in IPI.
    c. Identifies instances of IPI and the specific instructional resource used to vary instruction.
2. Describes the steps taken to individualize instruction in IPI:
    a. Names in order and explains each of the steps.
    b. Identifies the instructional resources and names the step in which they are used.
    c. Describes the mastery requirement in IPI.

PRETEST: Section I: How Instruction in Individualized in IPI

The following items constitute a pretest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Directions:

1. Take the pretest.
2. Use the answer key immediately following the pretest to correct your work.
3. Work on the pages to which you are directed by the pretest answer key.
4. Take the posttest.
5. Use the answer key immediately following the posttest to correct your work.
6. Move on to the next pretest if you have scored 100%.
7. Work on the pages to which you are directed by the posttest answer key if you have scored under 100%. Discuss these pages with other teachers working through this section.
8. Use the pretest as a posttest. (Alternate using the two test forms.)
9. Work toward 100% mastery.

Select the IPI resource varied in each statement. Write the letter of the correct answer in the blank on the right.

1. Teacher prescribes one third-grader the skill, C-Frac.-2, and another D-Num.-1 (a) Objectives (b) Achievement tests (c) Teaching techniques __________

2. Student is prescribed an abacus to help him master a skill in B-Num. (a) Instructional time (b) Materials and equipment (c) Objectives __________

3. Teacher prescribes a curriculum embedded test to assess student's mastery of skill 3 in D-COP (a) Teaching Techniques (b) Materials (c) Achievement tests. __________

Select the step taken in IPI described in each statement. Write the letter of the correct answer in the blank on the right.

4. Teacher uses curriculum embedded test to diagnose student's progress (a) mastery testing (b) diagnosing of learning needs (c) Ongoing evaluation. __________

5. Teacher specifies skills to be mastered (a) Diagnosis of learning needs (b) Ongoing evaluation (c) Writing prescription. __________

The statements below describe one of the following:
a. IPI
b. Generalized system of Individualization
c. Both

Select the correct answer and place the letter in the blank on the right.

6. Mastery requirement of 85%. __________

7. Flexible scheduling. __________

8. Learning goals are carefully sequenced. __________

9. Variety of arrangements of learning settings. __________

10. Teacher judgment used to assess learning characteristics. __________

ANSWER KEY

PRETEST: Section I: How Instruction is Individualized in IPI (pp. ~~73-95)~~ 74-94

1. a
2. b
3. c
4. c
5. c
6. a
7. b
8. c
9. c
10. a

HOW INSTRUCTION IS INDIVIDUALIZED

Instruction in IPI mathematics is individualized by varying:

1. IPI objectives from student to student;
2. IPI achievement tests from student to student;
3. IPI materials and equipment from student to student;
4. Teaching techniques from student to student;
5. Instructional time from student to student.

This IPI strategy is identical to the general strategy of individualized instruction. However, the specifics of the IPI strategy provide the teacher with:

1. An IPI Mathematics Continuum;
2. IPI achievement tests keyed to the Continuum;
3. IPI materials and equipment keyed to the Continuum;
4. IPI record system.

Though teaching techniques and instructional time are used to differeniate instruction in IPI, no IPI products in these areas have been developed yet. In IPI the teacher is expected to vary teaching techniques and instructional time based upon her judgment of student performance.

The following materials (Booklet I) will serve as a brief introduction to the way IPI resources are correlated to individualize instruction. Follow the directions on Booklet I.

Use this exercise with the materials in Level C, page 80.

THE FOLLOWING INSTRUCTIONS WILL HELP YOU LOCATE AN INSTRUCTIONAL OBJECTIVE IN THE IPI MATHEMATICS CONTINUUM AND TO RELATE IT TO SAMPLES OF IPI RESOURCES. USE THE 5 X 8 CARD TO UNCOVER THE ITEMS. FILL IN THE BLANKS.

1. Find the mathematics unit that is boxed in. This unit is called NUMERATION - Level ________________.

....

Level C

****

2. Find the first objective that is underlined. Objective 1 requires that the student read and write numerals 1-200 in ____________________________.

....

Sequence from any starting point.

****

3. Locate PRETEST: SAMPLE ITEMS. The underlined words indicate that these items measure achievement of ____________________ and ______________________

....

C-Numeration; Objective 1b

****

Inspect the sample items from the pretest. Do they ask the student to write numerals 1-200 in sequence from any starting point? ________________________

....

Yes. The items ask the student to write numerals in the sequences: 10-15; 63-68; 97-102; 122-127; 179-184.

****

. Compare the items with C-Numeration - Objective 1b. Are the items related to the objectives? __________

....

Yes. All IPI tests are keyed to IPI instructional objectives.

****

. Locate SAMPLE WORKSHEET. Do the items ask the student to practice writing numerals 1-200 in sequence from any starting point? ________________________

....

Yes. The student is asked to practice writing the sequences: 116-125; 96-105; 191-200.

****

7. Compare the worksheet items to the pretest items and C-Numeration-Objective 1b. Are they all concerned with reading and writing numerals 1-200 in sequences from any starting point? _______________

....

Yes. All IPI objectives, tests and worksheets are related.

****

8. When an IPI teacher selects a mathematics objective for a student, the teacher has many related (a) ______________________
and (b) ______________________
to choose from.

....

(a-b): tests, worksheets

****

END OF INSTRUCTIONS

C Numeration Pretest: Sample Items

1b

Directions: **Fill in the missing numbers.**

10	11	12	13		15
63	64	65		67	
97	98	99			
122	123			126	127
179			182	183	184

Sample Worksheet

C-Num-1

Name________________________ Date______ Grade______

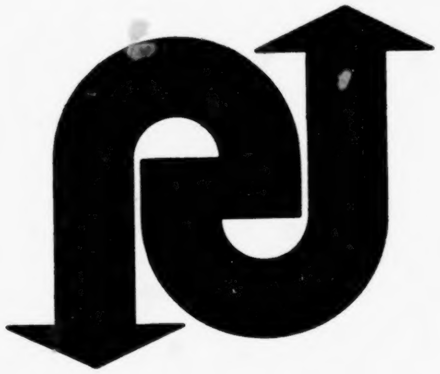
Fill in the missing numerals.

116	117			

	192			

96		98		

C-23



Booklet I

MATHEMATICS
CONTINUUM
Individually
Prescribed Instruction

	Level A	Level B	Level C	Level D
NUMERATION	1. Counts orally from 1 to 10. 2. Reads numerals 1-10. Left to right. 3. Number sequence 1-10, number relations. 4. Identifies, orally-written, cardinal numbers, concept of set. 5. Counts orally a set 1-10 objects. 6. Writes numerals from 1-10. 7. Written numbers 10 objects—ordered. 8. (9) Understands concept of (0) zero. 9. (10) Vocabulary skills—before, after, smaller, larger, etc.	1. Reads or matches numbers 1-10 orally. 2. Reads numerals 0 to 100. Counts 1-1000 by 1's orally. 3. Writes numerals 1-100 in order. Counts 1-100 by 10's, orally. 4. Identifies cardinal number of a structured group to 100. 5. Relationship of 10's. Writes names. 6. Identify larger > smaller < in a group. 7. Uses ordinals through tenth.	1. Reads, write numerals 1-200. Sequence from any starting point. 2. Supplies number 1 more, or less, or in between — 1 to 200. 3. Skip counts 2's, 5's, 10's to 200.	1. Reads, writes to 1,000. Any point. 2. Skip counts, by 3's, 4's from any point. 3. (a) Identifies and reads decimal fractions to hundredths. (b) Converts decimal numbers to fractions and other forms. (c) Fills in missing simple decimals.
PLACE VALUE			1. Identifies place value of the units, 10's, 100's to 200. Indicates >, <. 2. Writes numbers, columns 100's, 10's, units.	1. Identifies units, 10's 100's, 1000's. Uses >, <. Writes number before, after to 1,000. 2. Writes numerals, expanded notation, to 1,000. Regroup's, renames. 3. Uses number families, bridging, to work addition, subtraction problems. 4. (a) Gives place value of decimal fractions in fractional or other form. (b) Makes place value chart.
ADDITION	1. Associates objects in a 1 to 1 relationship. Equivalent-non equivalent groups. 2. Manipulates objects to illustrate add, subt. facts through No. 6.	1. Circles numeral-pictured addition. 2. Makes true number sentences using "+", "−", "=". Fills in missing sums and addends. 3. Mastery +, −, from 0 to 10. 4. Places "=" or "≠" in true or not true statements. 5. Selects other names for numbers. 6. Completes addition and subtraction sentences within number families. 7. Use of commutative principle (+). 8. Solves 1-step word problems. 9. Vocabulary skills.	1. Use of associative principle. 2. Adds 2 numbers — sum of 20. 3. Sums 2 or 3 numbers, no carrying. 4. Uses >, <, =. Equations, 2 step, combining add-subtract. 5. Works column addition — 3 or more addends, sums to 20.	1. Demonstrates mastery, sums thru 20. 2. Does column addition — no carrying. 3. Finds missing addends — 3 single digits 4. Uses words sum, addend — labels part. 5. Add, carrying to 10's using 2 digit numerals, 2 or more addends. 6. Adds, carrying to 10's, 100's, using 3 digit numerals, 2 or more addends. 7. Adds, carry 10's, 100's, using 3 digit numerals, 2 or more addends. 8. Finds sums, column addition. Using 2 or more addends of 1 digit.
UBTRACTION			1. Subt. problems — numbers to 18. 2. Subt. 2 digit — no borrowing. 3. Finds missing addend — 2 single digits.	1. Mastery subtraction facts, numbers to 20. 2. Subtraction no borrowing — 3 or more digits. 3. Subtraction borrowing 10's place — 2 digits. 4. Subtraction borrowing 10's, 100's — 3 digits. 5. Subtraction borrowing 10's, 100's — 3 digits.

level E	level F	level G	level H	level I
1. Counts, reads, writes to 1,000,000, any starting point. 2. Identifies odd-even numbers. States, uses rules for addition, subtraction, multiplication 2 numbers. 3. Rounds numbers to 10's, 100's, for comparison and estimating answers in sample word problems. 4. Gives numeral for 2, 3, 4 place number written in words, writes 2, 3, 4 place number in words. 5. Writes decimal fractions for common or mixed fractions of 10 or 100 denominator — vice versa. 6. (a) Identifies place values of decimals to thousandths. (b) Converts decimal fractions (to thousandths to other forms).	1. Rounds numbers to nearest thousands, ten thousands, millions, for estimating answers. 2. Writes numerals for a 5, 6, or more place number, writes words. 3. Locates prime numbers to 100 on a chart.	1. Tests any number to determine if it is prime or composite, finds prime factors of any given number. 2. Identifies numbers possible in base 5, writes base 5 numbers in expanded notation, converts decimal to base 5 and vice versa. 3. Adds and subtracts 1 and 2 digit numbers using base 5 expanded notation. 4. Adds and subtracts 1 & 2 digit numbers in base 5. No expanded notation. 5. Identifies and uses commutative principle for 1 & 2 digit base 5 addition. 6. Identifies and uses associative principle for adding more than 2 1 & 2 digit base 5 numbers.	1. Identifies numbers in base, 3, & 8. Changes numbers to base 10 and vice versa. 2. Adds and subtracts 1 & 2 digit numbers in base 2, 3 & 8 using expanded notation. 3. Adds and subtracts 1 & 2 digit numbers in base 2, 3, & 8 without expanded notation. 4. Identifies and uses the commutative principle for adding one and two digit numbers in base 5. 5. Identifies and uses the associative principle for adding more than 2 numbers (1 and 2 digits) in base 5. 6. Solves 1 step word problems which require adding and subtracting 1 and 2 digit base 5 numbers.	1. Identifies which numbers can appear in a base three, six, or seven system; writes numbers in the base in expanded notation; changes numbers written in base ten notation to numbers in this system and vice versa. 2. Adds and subtracts with one and two digit numbers using expanded notation in base three, six, or seven. 3. Adds and subtracts one and two digit numbers without using expanded notation in bases three, six, or seven. 4. Identifies and uses the commutative principle for adding one and two digit numbers in base three, six, or seven. 5. Identifies and uses the associative principle for adding one and two numbers of one or two digits in base three, six, or seven. 6. Solves one-step word problems which require adding and subtracting one and two digits in base three, six, or seven. 7. Uses repeated addition to solve multiplication problems in base three, five, six, or seven. 8. Solves multiplication problems with a number line for numbers in base three, five, six, or seven. 9. Completes a multiplication matrix for basic facts in base three, five, six, or seven. 10. Does multiplication of a one digit factor times a one or two digit factor for base three, five, six, or seven (may refer to above multiplication matrix). 11. Applies the distributive principle for multiplication in base three, five, six, or seven. 12. Solves one-step word problems requiring multiplication in base three, five, six, or seven. 13. Uses repeated subtraction to solve division problems in base three, five, six, or seven
1. Identifies place value digits to 1,000,000. Writes expanded notation, place value columns, uses >, <, relationship between 2 numbers to 1,000,000. 2. Uses multiples of 10 to generalize multiplication and division facts. Uses factors to 5. 3. Writes decimal as whole number plus sum of decimal part to thousandths place.	1. Charts large numbers by the place value of each digit. 2. (............... Thousandths). 3. Writes 10 as a power. Identifies the base and exponent or power of a term. 4. Writes a number, 1 thru 9 multiplied by itself a number times in exponential form. 5. Reads and counts decimal numbers to millionths.	1. Makes place value chart in base 5 for comparison with base 10.	1. Makes place value chart in base 2, 3 & 8 for comparison with base 10.	
1. Column addition, no carrying, 3 or more digit numbers, more than 2 addends. 2. Uses commutative principle of addition, 2 or more place numbers. 3. Uses associative principle for addition to add 2 or more place numerals. 4. Adds with carrying for 4 or more place numerals with 2 addends. 5. Adds 2 numbers, whole parts, and 1 or 2 decimal places. 6. Solves multiple-step word problems.	1. Adds — carrying 4 or more place numbers, more than 2 addends. 2. Adds, 2 or more numbers with whole number parts and decimals to the thousandths place or more.	1. Locates negative numbers, number line, thermometer, as preparation for arithmetic operations with negative numbers. 2. Adds 2 negative numbers, uses number line or thermometer — aid. 3. Adds negative and positive numbers. Uses number line or thermometer. 4. Writes whole or decimal numbers in scientific or exponential notation using positive powers of bases 2 thru 10. Adds any 2 numbers which are multiplied by the same base to the same positive power.	1. Adds all combinations of negative and positive numbers (more than 1 digit) without using a number line. 2. Writes small whole numbers or decimal numbers in scientific notat[illegible]sing negative powers of bases 2 th[illegible]). Adds 2 numbers which are multiplied by the same base to the same negative power. 3. Adds numbers with decimal parts to the thousandths place or more.	
1. Subtraction with borrowing, 4 or more place numbers. 2. Subtraction 2 numbers, whole number parts, 1 or 2 decimal places. 3. Solves multiple-step word problems.	1. Subtracts 2 decimal numbers with whole number parts and decimals to the thousandths place or more.	1. Subtracts 2 negative numbers. 2. Performs subtraction for a negative number minus a positive number and a positive number minus a negative number. 3. Does subtraction with numbers written in exponential form with the same base (2 thru 10) to the same positive number.	1. Does subtraction with numbers written in exponential form with the same base (2 thru 10) to the same negative power.	

level I continued on page 5

	level A	level B	level C	level D
MULTIPLICATION				1. Groups sets to complete statements. 2. Reprinted addition to solve multiplication problems. 3. Multiples using 0-1 as factors. 4. Oral-written multiplication factors 2, 3, 4, 5. 5. Fill-in frames — missing factors. 6. Completes 2 multiplication statements, illustrates commutative principle. 7. Uses terms, product, factors, labels. 8. Solves 1 step work problems, multiplication.
DIVISION				1. Divides a set into subsets. 2. Multiplies facts to solve division problems. 3. Uses terms product, factor, quotient. 4. Divides problems thru 45 ÷ 5 5. Divides 2, 3, 4, 5 by 1 and into 0. 6. Fill-in frames, missing quotient. 7. Solves 1-step problems thru 5 × 10.
COMBINATION OF PROCESSES			1. Find sums and differences in problems to 18 involving money values, measurement units. 2. Finds sums and differences in problems using time and geometric units. (Numbers to 18.) 3. Solves one-step problems adding and subtracting money, time & measurement values to 18. 4. Fills in >, <, =, ≠ in addition, subtraction problems using money, time and measurement values to 18. Uses + or − to make equation true.	1. Finds sums and differences, numbers to 500, 100 carrying, money (to 25¢), time and measurement units. 2. Same with carrying. 3. Multiples to 5 × 5, divides 45 ÷ 5, money (to 25¢), time and measurement units. 4. Solves 1 or 2 step word problems. 5. Supplies missing operational signs.

level E	level F	level G	level H	level I
1. Uses repeated addition to solve multiplication problems. 1 place times 1, 2, 3 place number. Combinations 9 × 9. 2. Uses commutative principle for multiplication. Solves problems, 1 place times 2 place factor. 3. Uses associative principle for multiplication. Multiplies more than 2 numbers with single digit factors. 4. Use distributive principle, single digit factors to simplify multiplication problems. 5. Multiplies 1 digit factor times 2 digit factor. 6. Multiplies 1 digit factor times a 3 or more digit factor. 7. Finds squares of numbers 2, 3, 4, 5. Write exponential form — identifies base and exponent. 8. Finds products 9 × 9, multiples of 10 to 10,000. Uses algorithm for multiplication by multiples of 10. 9. Multiplies 2 digits by 2 digits. 10. Solves multiple-step word problems.	1. Uses multiplication algorithm with 1 digit multiples. 2. Uses commutative principle for multiplication to solve problems, 2 places times 2 places. Checks by inverting factor order. 3. Uses associative principle to simplify multiplication of 1 & 2 digit numbers. 4. Uses distributive principle to simplify multiplication of 1 & 2 digit numbers. 5. Finds squares of numbers 6, 7, 8, 9 and identifies the exponential form. 6. Uses multiplication algorithm for a 2 digit number times a 2 or more digit number. 7. Multiplies a 3 digit number times a 3 or more digit number. 8. Finds products of 11's, 12's tables. 9. Multiplies decimal number times a whole number. 10. Multiplies a 1 place decimal number times a one or more place decimal number. 11. Solves multiple-step word problems.	1. Multiplies numbers in exponential form when the bases are the same. All powers positive (2 thru 10). 2. Multiplies 2 decimal numbers with decimal parts to the hundredths. 3. Multiplies 2 decimal number factors with decimal parts to the thousandths. 4. Applies distributive principle for multiplying decimal numbers.	1. Multiplies negative times positive, uses correct sign for the product. 2. Multiplies negative times negative and states the product is positive. 3. Multiplies numbers written in exponential form, with the same base with negative and for positive powers.	continued from page 3 14. Solves division problems with a number line for numbers in base three, five, six, or seven. 15. Does division with a two or more digit product divided by a one digit factor for three, five, six, or seven base number (may refer to multiplication matrix). 16. Applies the distributive principle for division in working with numbers in base three, five, six, or seven. 17. Solves one-step word problems requiring division in base three, five, six, or seven. 18. (H1) Develops the binary counting system (base two) and performs addition, subtraction, multiplication, and division in base two. 19. (H2) Develops the counting system for base twelve or other base created by the student. Adds, subtracts, multiplies, and divides in this base.
1. Uses distributive principle, simple numbers, simplify division problems. 2. Uses "ladder" division with 1 digit divisor, 2 or more digit dividend. No remainder. 3. Divides with remainders, 1 digit factor and product. 4. Divides with remainders, 1 digit factor, 2 or more digit products. 5. Checks division problems by inverse operation of multiplication for 2 or more digit products. 6. Finds missing factors or quotients for division problems thru 81 ÷ 9. 7. Solves 1-2 step word problems.	1. Uses repeated subtraction to solve division problems. 2. Divides a 2 or more digit product by a 2 or 3 digit factor. Rounds whole numbers to estimate quotients. 3. Uses division algorithm with 2 or 3 place factors, write R, remainder. 4. Uses fractional notation as a way of solving division problems written as fractions. 5. Divides decimal by whole number.	1. Writes a remainder as a fractional part of the divisor, reduces, lowest terms. 2. Uses distributive principle to simplify division problems for 2 or 3 digit products. 3. Divides numbers in exponential form when the bases are the same and all powers are positive bases 2 thru 10. 4. Divides numbers with decimals to the 100's place in both factor and product. Also, annexes zeroes when dividing by a larger number. 5. Divides numbers with decimals to the thousandths place in both factor and product. Rounds decimals, estimates quotients.	1. Performs division with a negative and positive number. Uses the correct sign for the quotient. 2. Divides a negative number by a negative number and states that the quotient is positive. 3. Divides numbers written in exponential form with the same base with negative and or positive numbers. 4. Finds square root of numbers by using the square root algorithm and applies the Pythagorean rule to right triangle problems. 5. Finds cubes of whole numbers. Identifies cube roots of numbers by using simple charts or experimentation.	
1. Adds, subtracts w wo carrying to 1,000 in any direction — money to $1.00, time units. 2. Solves, equations — "N" as a variable. 3. Multiplies, divides, combinations thru 9 × 9, 81 ÷ 9. 4. Supplies missing sign >, <, = or ≠ for combinations of +, −, × or ÷. Solves problems, multi-operations. 5. Finds averages for simple numbers. 6. Solves 1 or 2 step word problems with fractions to ⅛, time, money, measurement units, numbers to 1,000.	1. Adds, subtracts to 1,000,000 all directions. Money, time, measurement units. 2. Multiplies, divides, with algorithm to 1,000,000. 3. Supplies missing >, <, = or ≠ in addition, subtraction, multiplication, division problems to 1,000,000. 4. One-, two-step word problems using all processes, fractions, money, time, measurement units.	1. Adds, subtracts positive and negative numbers. 2. Adds, subtracts, multiplies and divides decimals to 2 places. 3. All processes all fractions. 4. Solves 1- and 2-step word problems. 5. Multiplies to find % of whole numbers.	1. Solves multiple step word problem. 2. Solves insurance problems — straight life, endowment insurance, etc. 3. Solves problems involving tax rate in mills per dollar. 4. Solves banking problems — checks, depositing, withdrawing money. 5. Solves stock and bond problems.	

	level A	level B	level C	level D
FRACTIONS	1. Identifies one-half of an object(s). 2. Uses terms whole, one-half in reference to objects or sets of objects.	1. Divides object(s) in half, limit 12.	1. Divides object. Uses $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$. 2. Identifies $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$. 3. Divides sets — $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$. 4. Identifies $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, — set of objects.	1. Identifies objects using $\frac{1}{6}$, $\frac{1}{8}$, $\frac{2}{3}$, $\frac{3}{4}$. 2. Divides sets of objects into parts. 3. Adds any 2 fractions with same denominator. 4. Adds 2 fractions, same denominator which equals a whole number. 5. Identifies an equivalent fraction for a given fraction, using pictures.
MONEY		1. Knows value—penny, nickel, dime. 2. Matches coins with numerical value, word cent used. 3. Recognizes quarter. 4. Finds values, pennies and nickels, uses ¢ sign.	1. Finds value, penny, nickel, dime, quarter. 2. Identifies coins, totals coins.	1. Identifies $\frac{1}{2}$ dollar, dollar, finds value, uses dollar sign. 2. Totals coins, bills, greater, less, equal. 3. Writes money values using signs. 4. Identifies change in coins. 5. Solves one step word problems.

level E	level F	level G	level H	level I
1. Uses simple fractions (1/5, 1/8, 1/10, 1/12) in dividing whole objects. Uses fraction words. 2. Places >, <, or = between 2 simple fractions to show relationship. Reduces fractions to lowest terms. 3. Finds fractional parts of whole numbers giving a whole answer number. 4. Uses "numerator" — "denominator" to identify fraction parts. 5. Adds 2 or more fractions same denominator. Performs subtraction of fractions. Reduces to lowest terms. 6. Changes to equivalent fractions. Responds to "reduce fractions to lowest terms."	1. Identifies an improper fraction and changes improper fractions to mixed fractions in lowest terms. 2. Uses >, <, =, or ≠ to show relationship between pairs of simple fractions, improper fractions, mixed fractions. Rearranges fraction groups in order of largest or smallest first. 3. Finds LCM for a set of whole numbers and finds the LCM for a given set of fractions. 4. Performs simple addition, subtraction and multiplication with fraction having unlike denominators using picture regions, number lines, etc. 5. Finds greatest common factor for a set of numbers and uses the greatest common factor to reduce fractions to lowest terms. 6. Uses the algorithm for addition and subtraction of fractions, finds LCD. 7. Performs complex addition, subtraction of fractions unlike denominators. Reduces to lowest terms. Uses commutative and associative laws in solving addition problems. 8. Performs column addition, 2 or more simple fractions, like and unlike denominators. Reduces to lowest terms. Performs column subtraction. 9. Adds, subtracts fractions and whole numbers with improper fractions and mixed fractions. Answers, lowest terms. 10. Uses >, <,and = to show relationship between 2 step equations using fractional expressions with +, −, and ×. 11. Writes decimal equivalent for simple fractions (½, ¼ etc.). Changes decimal equivalents to fractions. 12. Solves one-step word problems.	1. Writes decimal equivalent for any proper or improper fraction and changes decimal equivalents to fractions. 2. Performs complex multiplication of fractions. Answers in lowest terms. 3. Divides simple fractions, improper fractions, mixed fractions by using reciprocals. Lowest terms. 4. Uses multiplication algorithm for multiplying all fractions. Applies distributive principle with fractions. 5. Solves problems with fractions raised to whole number powers. 6. Uses the division algorithm for dividing simple, improper, complex, mixed fractions. 7. Solves word problems.	1. Finds the value of a whole number raised to a fractional power.	
1. Identifies change in coins with purchase amounts up to $5.00. 2. Totals purchases, amounts less than $5.00. Indicates change. Counts out change starting with the total value of the purchase. 3. Adds-subtracts money values, two or more using cent and decimal notation. 4. Multiplies-divides money values using $ sign and decimal point.	1. Solves multiple-step word problems involving multiplication and division of money values.			

	level A	level B	level C	level D
TIME		1. Reads numerals to 12 on clock face, orally. 2. Writes numerals to 12 on clock face. 3. Given only hour hand pointing between 2 numerals identifies interval as "before" and "after."	1. Counts 60 objects in a line. Every 5th object larger than others. 2. Counts from beginning 60 object line to intermediate point indicated by arrow. 3. Counts as above not distracted by 1-12 under each heavy object. 4. Indicates number or objects in line with marker on number line. 5. Does 3 & 4 above with line bent into circle. Calls objects minutes.	1. Selects matching clock faces. 2. Matches clock face to printed time. 3. Selects printed time to match clock face. 4. Draws hour, minute hand, draws both to show printed time. 5. Writes down other way to state times. 6. Matches statements about time, time statements and clock faces. 7. Supplies minute count. 8. Supplies hour statement. 9. Writes time from clock face. 10. Draws time on face from statement.
SYSTEMS OF MEASUREMENT		1. Demonstrates comparative concepts. 2. Recognizes use of ruler, yardstick. 3. Ruler divisions, inches, 3 rulers = 1 yard. 4. Identifies dozen, one-half object(s).	1. Uses inch ruler, measures objects. 2. Utilizes foot ruler.	1. Problems — 3 ft. = 1 yd., 36 in. = 1 yd. 2. Uses equivalent liquid measures. 3. Word problems — equivalent measures. 4. Measures lines, objects to ½, ¼ inch.

level E	level F	level G	level H	level I
1. Identifies day of week and date using calendar. 2. Answers questions involving words "morning" "afternoon" "evening." 12 noon, 12 midnight identified as dividing times. 3. Identifies calendar units. Constructs calendar. 4. Writes time in hours from clock face. Puts hands on clock face. Responds to written "o'clock." 5. Writes time from clock face — half and quarter hours. Puts hands on clock face. Responds to "Half-Past ....," "........... thirty," "Quarter past ....," "Quarter to ...." 6. Uses and responds to use of colon (:). 7. Uses in writing AM for morning, PM for afternoon. 8. Writes any date as month, day and year. 9. Makes and uses calendar to study equivalent units. Locates information on calendar. 10. Finds number of minutes between two minute hand readings. 11. Solves time problems adding or subtracting hours or half hours on a clock. 12. Writes time from clock face, 5 & 1 min. intervals. "Minutes past," "Minutes to" and "........... o'clock." 13. Adds, subtracts time units in one-step problems. No re-grouping. 14. Solves simple problems using Bus, Train, Plane schedules. 15. Identifies second hand on clock. Learns duration of second and 60 seconds in a minute. 16. Add-subtract problems with weeks, days, minutes, and seconds which require regrouping of units.	1. Adds, subtracts units of time extending beyond 12:00. 2. Identifies equivalent values, decodes fortnight, score, century, leap year days. 3. Reads time — 24 hr. clock. 4. Identifies time zones, work problems requiring time changes. 5. Identifies the change which daylight saving time makes in solving time problems.			
1. Solves problems requiring conversion of tons into pounds, pounds into ounces, equivalent measures of ounces-pounds, pounds-tons. 2. Adds, subtracts, multiplies, divides, denominant numbers, uses regrouping to combine same units. 3. Solves problems using speedometer and temperature readings. 4. Uses equivalent measures — feet, rod, yard, mile. Solves problems using these conversions. 5. Uses a ruler to measure in centimeters. 6. Measures lines — nearest inch and centimeter. Makes comparisons.	1. Performs conversions between metric and English measures. 2. Uses a meter stick for measuring.			

	level A	level B	level C	level D
GEOMETRY		1. Identifies figures, circle, square, triangle, rectangle. 2. Reproduces, memory-circle, square, triangle. rectangle.	1. Recognizes, names solids, sphere, cube, cone, rectangular prism. 2 Learns Roman numerals, 1 to 30.	1. Identifies, curves, lines, segments, corners.
SPECIAL TOPICS				1. Roman numerals 30 to 100. 2. Reads thermometer — records temperature using degree symbol. 3. Reads bar graph to locate information.
SUPPLEMENTARY TOPICS			1. Patterns, sets, 1 to 1 matching with number line. 2. Sets, addition, subtraction tables, magic squares for addition, subtraction. 3. Number line — addition, subtraction, introduction to measurement, addition squares.	1. Uses an abacus, crossword puzzles, with number concepts.

level E	level F	level G	level H	level I
1. Identifies parts of a line segment. Names a line for any 2 points in it. 2. Identifies a right angle and names angle by three points. 3. Recognizes simple geometric figures, equilateral, right triangle, quadrilateral. 4. Identifies lines which "look parallel." 5. Uses compass — draws circle. 6. Identifies intersecting lines, locates point of intersection. 7. Names points in a line, dot used as a representation of a point. 8. Measures line segment to nearest ½ and ¼ inch. 9. Identifies lines which are perpendicular.	1. Finds perimeters — squares, triangles, quadrilaterals, polygons by measuring. 2. Uses square inch model to find areas of simple plane figures. Solves simple area problems and makes conversions among square units. 3. Uses a 1 cubic inch square as a model to find volumes of simple solids. Solves volume problems. 4. Identifies plane geometric figures: trapezoid, pentagon, hexagon, and other regular polygons. 5. Locates circle parts: center, radius, diameter, chord, arc, semicircle. 6. Identifies a "ray" as a line segment with 1 endpoint and extending indefinitely in the other direction. 7. Measures line segment to the nearest ⅛ and $\frac{1}{16}$ of an inch. 8. Uses compass to bisect a line segment, construct a line perpendicular to a given line. 9. Identifies the vertex of a triangle or angle.	1. Identifies plane geometric figures: parallelograms, rhombus, convex and concave irregular polygons. 2. Finds perimeter for: parallelograms, rhombi, regular, irregular polygons by measuring. 3. Measures angles using protractor, draws angles. Identifies acute and obtuse angles. 4. Identifies value of "Pi," π, and can demonstrate its derivation. 5. Finds circumference and area of a circle using the formulas: $C = \pi D = 2\pi R$, and $A = \pi R^2$ 6. Uses formulas to find perimeter of: square, rectangle and triangle.	1. Finds surface area of prisms and cylinders. 2. Uses formulas to find volumes of familiar solids — prisms, cylinders, pyramids, cones. 3. Identifies congruent line segments and angles. Constructs a line segment or angle congruent to a given line segment or angle. 4. Constructs parallel lines cut by a transversal. Identifies transversal. Constructs perpendicular. Identifies right angles. 5. Identifies angles formed by a transversal. Demonstrates vertical angles (pairs), corresponding are congruent. 6. Identifies polyhedra (prisms, cylinders, cones, pyramids, cubes), and finds their surface area.	
1. Writes Roman numerals for numbers to 500. 2. Reads distances from simple maps. 3. Reads and makes graphs-charts.	1. Writes ratios as fractions, finds missing terms in a proportion. 2. Converts fractions and decimals to percents and vice versa. 3. Completes patterns for "what's my rule?" games, solves function problems by finding the rule. 4. Solves conversion problems using acre, sq. yd., rod, sq. mile. 5. Reads, makes graphs and charts, including bar, line graphs with fractions and decimals.	1. Locates points on a coordinate plane and graphs ordered pairs. 2. Uses Venn diagrams to picture union and intersection of sets. 3. Translates problems into equations and solves simple algebraic equations with one unknown.	1. Identifies integers, rational, irrational numbers, identifies sets which exhibit the closure property. 2. Completes mathematical and geometric logical deductive statements, using "if ...., then ...." 3. Makes charts to compare United States currency with that of other countries.	
1. Using an abacus, magic squares, review pages and test pages.	1. Multiplication and addition squares, cross-number puzzles, scale drawings, review pages and test pages.	1. Arrays, number line games, review pages and test pages.	1. Vocabulary words, other numeration systems, congruent triangles, review pages, and test pages.	

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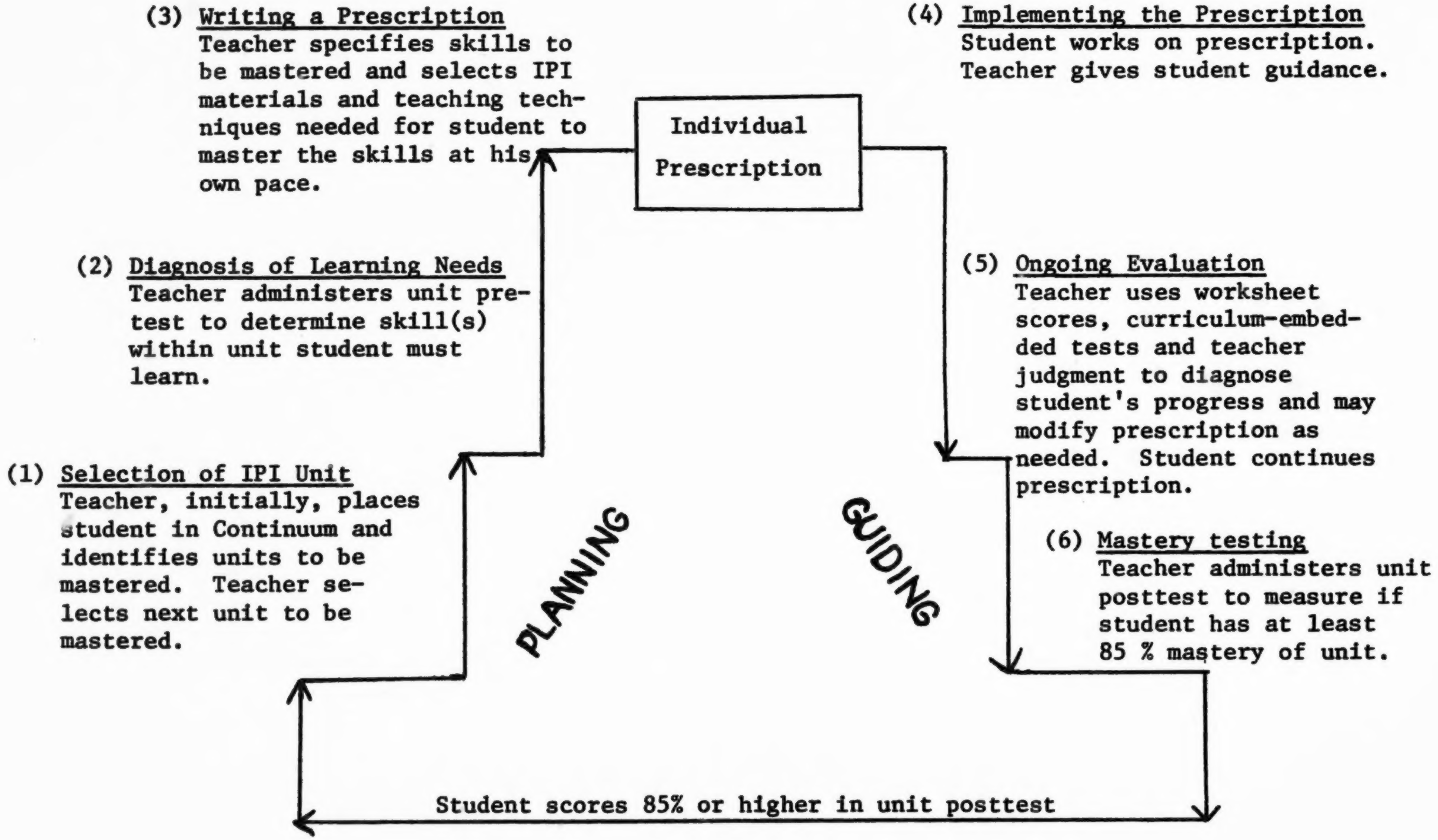
The steps an IPI teacher takes in planning and conducting IPI in the classroom closely resemble the general procedures followed in a system of individualized instruction. Figure 6 takes these general procedures and translates them into the specific steps used in IPI. Study Figure 6 carefully to follow the flow of instruction in IPI.

Figure 6: Steps in Individually Prescribed Instruction



(1) Selection of IPI Unit
Teacher, initially, places student in Continuum and identifies units to be mastered. Teacher selects next unit to be mastered.

(2) Diagnosis of Learning Needs
Teacher administers unit pretest to determine skill(s) within unit student must learn.

(3) Writing a Prescription
Teacher specifies skills to be mastered and selects IPI materials and teaching techniques needed for student to master the skills at his own pace.

(4) Implementing the Prescription
Student works on prescription. Teacher gives student guidance.

(5) Ongoing Evaluation
Teacher uses worksheet scores, curriculum-embedded tests and teacher judgment to diagnose student's progress and may modify prescription as needed. Student continues prescription.

(6) Mastery testing
Teacher administers unit posttest to measure if student has at least 85 % mastery of unit.

Student scores 85% or higher in unit posttest

THE FOLLOWING STATEMENTS WILL HELP YOU DESCRIBE THE STEPS IN INDIVIDUALLY PRESCRIBED INSTRUCTION. USE THE 5 X 8 CARD TO UNCOVER THE ITEMS. REFER TO FIGURE 6 AS NEEDED.

EXERCISE

I. Match the items in Column A to the items in Column B by drawing a line between related items:

COLUMN A	COLUMN B
Steps in Individually Prescribed Instruction	Activities
1. Selection of IPI unit	a. Student works on prescription. Teacher gives student guidance.
2. Diagnosis of learning needs	b. Teacher specifies skill to be mastered and selects IPI materials and teaching techniques needed for student to master the skills.
3. Writing a learning prescription	c. Teacher selects next unit to be mastered.
4. Implementing the prescription	d. Teacher administers unit pretest to determine skill (s) within unit student must learn.
5. Ongoing evaluation	e. Teacher administers unit post-test to measure student's mastery of unit.
6. Mastery testing	f. Teacher uses curriculum-embedded tests and teacher judgement to diagnose the student's progress; may modify prescription. Student continues prescription.

....

1 - c; 2 - d; 3 - b; 4 - a; 5 - f; 6 - e

II. Complete

1. In IPI, the student's program of studies is called
(a) ________________________.

....

a. Prescription

****

2. In IPI, the teacher:

a. Varies objectives in Step(s) ________________.
b. Varies materials and equipment in Step(s) ______________.
c. Varies teaching techniques in Step(s) _______________.
d. Varies instructional time in Step(s) _______________.
e. Uses IPI achievement tests in Step(s) _______________.
f. Requires 85% mastery of unit in Step(s) _______________.

....

a. Steps 1 and 5
b. Steps 3 and 5
c. Steps 3 and 5
d. Steps 3 and 5
e. Steps 2, 5 and 6
f. Step 6

****

END OF EXERCISE

POSTTEST: Section I: How Instruction is Individualized in IPI

The following items constitute a posttest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Use the directions given with the pretest.

Select the IPI resource varied in each statement. Write the letter of the correct answer in the blank on the right.

1. Teacher prescribes one third-grader the skill, C-Frac.-2, and another D-Num.-1 (a) Objectives (b) Achievement tests (c) Teaching techniques ______

2. Student is prescribed an abacus to help him master a skill in B-Num. (a) Instructional time (b) Materials and equipment (c) Objectives ______

3. Teacher prescribes a curriculum embedded test to assess student's mastery of skill 3 in D-COP (a) Teaching Techniques (b) Materials (c) Achievement tests. ______

Select the step taken in IPI described in each statement. Write the letter of the correct answer in the blank on the right.

4. Teacher uses curriculum embedded test to diagnose student's progress (a) mastery testing (b) diagnosing of learning needs (c) Ongoing evaluation. ______

5. Teacher specifies skills to be mastered (a) Diagnosis of learning needs (b) Ongoing evaluation (c) Writing prescription. ______

The statements below describe one of the following:

a. IPI
b. Generalized system of Individualization
c. Both

Select the correct answer and place the letter in the blank on the right.

6. Mastery requirement of 85%. ______

7. Flexible scheduling ______

8. Learning goals are carefully sequenced ______

9. Variety of arrangements of learning settings ______

10. Teacher judgment used to assess learning characteristics ______

ANSWER KEY

POSTTEST: Section I: How Instruction is Individualized in IPI (pp. [illegible]) 74-94

1. a
2. b
3. c
4. c
5. c
6. a
7. b
8. c
9. c
10. a

TEACHING IN IPI

Summary Sheet: An Overview of Individualized Instruction and IPI

Generalized System of Individualized Instruction	IPI: A Specialized System of Individualized Instruction
DEFINITION	
Individualized instruction consists of the planning and conducting of instruction in a systematic way that provides each student with a program of studies suited to his learning needs and characteristics.	IPI is an instructional system in which teachers use a set of behavioral objectives correlated with diagnostic instruments and curriculum materials, teaching techniques and pacing to plan and conduct with each student an individual learning prescription.
STRATEGY FOR INDIVIDUALIZING INSTRUCTION	
1. Vary instructional objectives from student to student. 2. Vary the diagnostic instruments from student to student. 3. Vary learning materials and equipment from student to student. 4. Vary learning settings from student to student. 5. Vary teaching methods from student to student. 6. Vary instructional time from student to student.	1. Vary skill objectives from student to student. 2. Vary IPI achievement tests from student to student. 3. Vary IPI worksheets, supplementary materials and devices from student to student. 4. Vary learning techniques (learning settings and teaching methods) from student to student. 5. Vary pacing from student to student.
STEPS IN INDIVIDUALIZING	
1. Selection of instructional objective. 2. Diagnosis of learning needs. 3. Prescription of program of studies. 4. Implementing prescribed program. 5. Ongoing evaluation. 6. Mastery testing.	1. Selection of IPI unit. 2. Diagnosis of learning needs. 3. Developing a prescription. 4. Implementing the prescription. 5. Ongoing evaluation. 6. Mastery testing.

TEACHING IN IPI

Glossary

Behavior: Any overt, observable activity exhibited by the student.

Diagnosis: Determination of the learning needs and characteristics of a student from data obtained by the use of diagnostic instruments.

Diagnostic instruments: Testing devices and assessment procedures used to gather data on student behavior in terms of learning needs and characteristics.

Flexible scheduling: The allocation of instructional time to different subject areas.

Implement: Carry out or execute a plan for instruction or a Prescription as designed.

Instructional resources: All objects, devices, physical facilities, and arrangements used by the teacher and students in an instructional program.

Instructional time: The amount of time a student spends in a subject area (flexible scheduling) or on a particular learning goal (pacing).

Learning characteristics: A set of student behaviors which can facilitate or impede his learning something new. Such things as organic development and peer-group relations affect the student's learning process and are characteristic of how he performs in school.

Learning needs: A behavior or part of a behavior that a student must master. It describes what the student needs to learn in relation to a particular learning goal.

Learning settings: Arrangements or groupings of students ranging from one student to large group instruction with or without the direct involvement of the teacher. The groups are formed on the basis of individual needs and are not permanent arrangements.

Mastery: A stated criterion of minimum acceptable competency in performing a specific behavior.

Materials and Equipment: All printed materials, audio-visual aids, mechanical devices, laboratory supplies, and objects that contain or convey information in an instructional program.

Mathematics Continuum: A sequence of behavioral objectives.

Objective: A description of the intended outcomes of instruction. It may be expressed as a very broad, general goal, a more specific goal or a very specific description of student behavior. Depending upon its degree of specificity, it may be called a goal, aim, purpose, objective (instructional or behavioral), skills, etc.

Pacing: Rate of progress through the IPI continuum or any curriculum which allows the individual student to master the skills or objectives. Pacing refers to the amount of instructional time spent on a particular objective.

Prescribe: Select and describe the instructional resources needed for a student to master a learning goal or objective.

Teaching Methods: Specific procedures for guiding a student in learning a new behavior. The method, selected by the teacher, may or may not require the teacher's direct supervision as in the use of small group discussion or self-instructing materials.

TEACHING IN IPI

Section II

BEHAVIORAL OBJECTIVES AND THE IPI CONTINUUM

A. Behavioral objectives and the Specific Objectives in IPI Mathematics

B. Organization of the IPI Mathematics Continuum

Suggested setting: Group of 2-3

This section discusses the importance of behavioral objectives in a system of individualized instruction. It also describes the IPI Mathematics Continuum in detail.

BEHAVIORAL OBJECTIVES AND THE SPECIFIC OBJECTIVES IN IPI MATHEMATICS

BEHAVIORAL OBJECTIVES AND THE SPECIFIC OBJECTIVES IN IPI MATHEMATICS

The teacher identifies behavioral objectives:

1. Selects objectives stated in terms of the learner doing or producing something.
2. Identifies that part of the statement which describes the action or product.
3. Identifies in the objectives the conditions for performance.
4. Identifies the mastery criterion contained in the objective.

PRETEST: Section II: Behavioral Objectives and the Specific Objectives in IPI Mathematics

The following items constitute a pretest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Directions:

1. Take the pretest.
2. Use the answer key immediately following the pretest to correct your work.
3. Work on the pages to which you are directed by the pretest answer key.
4. Take the posttest.
5. Use the answer key immediately following the posttest to correct your work.
6. Move on to the next pretest if you have scored 100%.
7. Work on the pages to which you are directed by the posttest answer key if you have scored under 100%. Discuss these pages with other teachers working through this section.
8. Use the pretest as a posttest. (Alternate using the two test forms.)
9. Work toward 100% mastery.

Answer Yes or No

1. To name five principles of learning.

   This statement is stated in terms of the learner doing or producing something ____________

2. To teach the important events occuring during the "Golden Age of England."

   This statement is stated in terms of the learner doing or producing something. ____________

3. Place a check mark next to the words in the column which describes observable learner behavior.

   (a) To enjoy (a)____________

   (b) To list (b)____________

   (c) To know (c)____________

   (d) To recite (d)____________

   (e) To write (e)____________

Answer Yes or No

4. To name orally the 50 states zip codes appropriate to each of the states.

   This statement indicates the condition necessary for the behavior to occur. ____________

5. To identify lower and upper case letters

   This statement indicates the conditions necessary for the behavior to occur. ____________

6. Given a human skeleton, the student must be able to correctly identify by labeling at least 40 of the following bones; there will be no penalty for guessing (list of bones inserted here).

   This statement indicates the minimum acceptable mastery criterion. ____________

7. Given an otherwise properly functioning TV receiver the learner must be able to adjust the ion trap.

This statement indicates the minimum acceptable mastery criterion. ____________

Write the letter of the correct answer in the blank on the right.

8. When presented with a form the student must fill out a standard accident report.

This statement: ____________

(a) Omits the stating of the minimum acceptable.
(b) Does not contain a verb which describes observable learner behavior.
(c) Omits the condition necessary for the behavior to occur.

9. To identify a well-balanced breakfast, given the foods to be eaten and amounts, within 10 seconds.

This statement: ____________

(a) Does not fulfill the criteria for indicating who is doing the behaving.
(b) Contains all criteria of a behavioral objective.
(c) Does not contain a verb which describes observable learner behavior.

10. To identify the twelve months and the seven days with 100% accuracy.

This statement: ____________

(a) Contains all criteria of a behavioral objective.
(b) Omits the condition necessary for the behavior to occur.
(c) Omits the stating of the minimum acceptable mastery criterion.

ANSWER KEY

PRETEST: Section II: Behavioral Objectives and the Specific 114
Objectives in IPI Mathematics (pp. 109-~~113)~~

1. Yes

2. No

3. (a)
   (b) ✓
   (c)
   (d) ✓
   (e) ✓

4. No

5. No

6. Yes

7. Yes

8. a

9. b

10. b

Audio-Tape #2: Claire Moshy, *Identifying Behavioral Objectives*. Research for Better Schools, Inc. (Philadelphia, Penna.) 1967.

DIRECTIONS: Listen to Audio-Tape #2 and follow the directions as given.

Behavioral Objectives

The following criteria will help you identify a behavioral objective. A behavioral objective is stated in terms of:

1. The learner;
2. Observable behavior;
3. Conditions of performance;
4. Mastery criterion (if not specified, it is 100%).

EXERCISE

(for Audio-tape #2)

Criterion 1: Who is doing the behaving?

	Learner	Teacher
1. To name the time zones in the United States.		
2. To teach the causes of the Civil War.		
3. To use a film to introduce simple machines.		
4. To state the causes of the Civil War in writing.		
5. To construct a model airplane.		
6. To cover the use of a comma.		
7. To name the letters of the alphabet in order.		

END OF EXERCISE

(Turn on the recorder.)

EXERCISE

(for Audio-tape #2)

Criterion 2: Is the learner doing or producing something?

	YES	NO
1. To name the three primary colors from memory.		
2. To understand that multiplication is repeated addition.		
3. To appreciate the literary value of Greek lyric poetry.		
4. To construct an outline of Chapter 12 in the history book.		
5. To list chronologically the events leading up to World War I.		
6. To develop good health habits.		
7. To know how a radio works.		
8. The learner describes the function of the United Nations.		

END OF EXERCISE

(Turn on the recorder.)

EXERCISE

(for Audio-tape #2)

Criterion 3: Under what conditions is the learner-behavior to occur?

1. Given a vocabulary list of 95 most common nouns, the student will pronounce all the words correctly.
2. To identify upper and lower case letters.
3. To identify well-balanced meals when presented with ten breakfast menus.
4. To name the prehistoric animals when given pictures of them.
5. To recite the "Ancient Mariner."
6. To name the fifty states orally when presented with their zip codes.
7. To fill in the names of the months and the days of the week on a calendar.

END OF EXERCISE

(Turn on the recorder.)

EXERCISE

(for Audio-tape #2)

Criterion 4: What is the mastery criterion?

1. To count to twenty accurately from memory within twenty seconds.
2. To reduce a given list of fractions to lowest terms.
3. To alphabetize a random list of works with 100% accuracy.
4. To assemble a jigsaw puzzle within fifteen minutes.
5. To translate orally into English a selected French poem.
6. To name each primary and secondary color, when presented with a series of colored cards.
7. To run a 110-yard low hurdle race conforming to AAU standards.

END OF EXERCISE

(Turn on the recorder.)

POSTTEST: Section II: Behavioral Objectives and the Specific Objectives in IPI Mathematics

The following items constitute a posttest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Use the directions given with the pretest.

Answer Yes or No:

1. To identify the five basic parts of a green plant.

   This statement is stated in terms of the learner doing or producing something. ______________

2. To use a film to demonstrate how to construct an aquarium.

   This statement is stated in terms of the learner doing or producing something. ______________

3. Place a check mark next to the words in the column which describes observable learner behavior.

   (a) To believe (a) ______________

   (b) To circle (b) ______________

   (c) To understand (c) ______________

   (d) To appreciate (d) ______________

   (e) To multiply (e) ______________

Answer Yes or No:

4. To name a dinosaur given a picture of one.

   This statement indicates the condition necessary for behavior to occur. ______________

5. To write the names of the 50 states given the abbreviations.

   This statement indicates the condition necessary for behavior to occur. ______________

6. The student must be able to spell correctly at least eight of the ten words called out to him during an examination period.

   This statement indicates the minimum acceptable mastery criterion. ______________

Answer Yes or No:

7. The student must be able to use the chemical balance well enough to weigh materials accurately to the nearest milligram.

   This statement indicates the minimum acceptable mastery criterion. ____________

Write the letter of the correct answer in the blank on the right:

8. To list the three most important causes of the Civil War as agreed upon by at least two references given unlimited access to six references.

   This statement: ____________

   (a) Does not fulfill the criteria for indicating who is doing the behaving.
   (b) Omits the conditions necessary for the behavior to occur.
   (c) Omits the stating of the minimum acceptable mastery criterion.

9. To know 4 out of 5 plays of Shakespeare when presented with their titles.

   This statement: ____________

   (a) Contains all criteria of a behavioral objective.
   (b) Does not fulfill the criteria for indicating who is doing the behavior.
   (c) Does not contain a verb which describes observable learner behavior.

10. Given a contract with certain legal terms circled, the student is asked to write a definition of each of the circled terms.

    This statement: ____________

    (a) Omits the condition necessary for the behavior to occur.
    (b) Omits the stating of the minimum acceptable mastery criteria.
    (c) Contains all the criteria of a behavioral objective.

ANSWER KEY

POSTTEST: Section II: Behavioral Objectives and the Specific 114
Objectives in IPI Mathematics (pp. 109-~~113~~)

1. Yes

2. Yes

3. (a)
   (b) ✓
   (c)
   (d)
   (e) ✓

4. Yes

5. Yes

6. Yes

7. Yes

8. C

9. C

10. C

As we examine the IPI Mathematics Continuum, we can apply the distinctions made concerning different levels of learning goals and objectives in Audio-tape #2.

The general aims of education in America indicate that children should study mathematics. This then is the broad general level. Defining the particular course of study and defining of each area within the Mathematics Continuum can be considered the second, more concrete, level. Stating the specific objectives or skills in each unit of mathematics is the most specific or behavioral level of the Continuum.

The general and concrete levels are important to you as an IPI teacher. They give you a setting for the part you play in developing a student who is competent in IPI mathematics.

The specific behavioral objectives or skills are most important to you since they will be an integral part of your day-to-day teaching. These are the skills that will be examined in terms of the four criterion questions:

1. Who is doing the learning?
2. Is the learner doing or producing something?
3. Under what conditions is the learner-behavior to occur?
4. What is the mastery criterion?

ORGANIZATION OF THE IPI MATHEMATICS CONTINUUM

ORGANIZATION OF THE IPI MATHEMATICS CONTINUUM

The teacher describes the IPI Mathematics Continuum with the use of a chart of the Continuum:

1. Locates and names the areas, levels, units and skills on the Continuum.
2. Describes the Mathematics Continuum, its areas, levels and skills in terms of generality and specificity, and in terms of 4 selected criteria of behavioral objectives.
3. Explains the sequence in the Continuum.
4. Lists a given set of units in the order in which they would be studied by a student.

PRETEST: Section II: Organization of the IPI Mathematics Continuum

The following items constitute a pretest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Directions:

1. Take the pretest.
2. Use the answer key immediately following the pretest to correct your work.
3. Work on the pages to which you are directed by the pretest answer key.
4. Take the posttest.
5. Use the answer key immediately following the posttest to correct your work.
6. Move on to the next pretest if you have scored 100%.
7. Work on the pages to which you are directed by the posttest answer key if you have scored under 100%. Discuss these pages with other teachers working through this section.
8. Use the pretest as a posttest. (Alternate using the two test forms.)
9. Work toward 100% mastery.

A	B	C	D	E	F	G	H
Numeration							
place Value							
Addition and Subtraction in Other Bases							
Addition							
Subtraction							
Multiplication and Division in Other Bases							
Multiplication							
Division							
Combination of Processes							
Fractions							
Money		(1)					
Time							
Systems of Measurement							
Geometry							
Special Topics							

Complete the following statements by writing the appropiate answer in the column of blanks provided on the right. Use the graph to find the answers.

1. The levels range from (a) ______ (b) ______ (a) ______
   (b) ______
2. The circled box (1) represents (a) ______ (a) ______
3. D Subtraction is (a) ______ (a) ______
4. Special Topics is (a) ______. (a) ______

Complete the following statements by writing the appropriate answer in the column of blanks provided on the right.

5. Each unit contains behavioral objectives called (a) ____________. (a) ____________

6. (a) ____________ are specifically defined in the Continuum. (a) ____________

7. At present there are (a) ____________ units in the Continuum. (a) ____________

Answer True or False.

8. A student beginning in C Numeration would be expected to have mastered all units in levels A and B. ____________

9. Areas are specifically defined in the Continuum. ____________

10. The units contain different numbers of skills. ____________

ANSWER KEY

126-149

PRETEST: Section II: Organization of the IPI Mathematics Continuum (pp. ~~125-128)~~

1. A-H
2. unit
3. unit
4. area
5. unit skills
6. objectives
7. 86
8. True
9. False
10. True

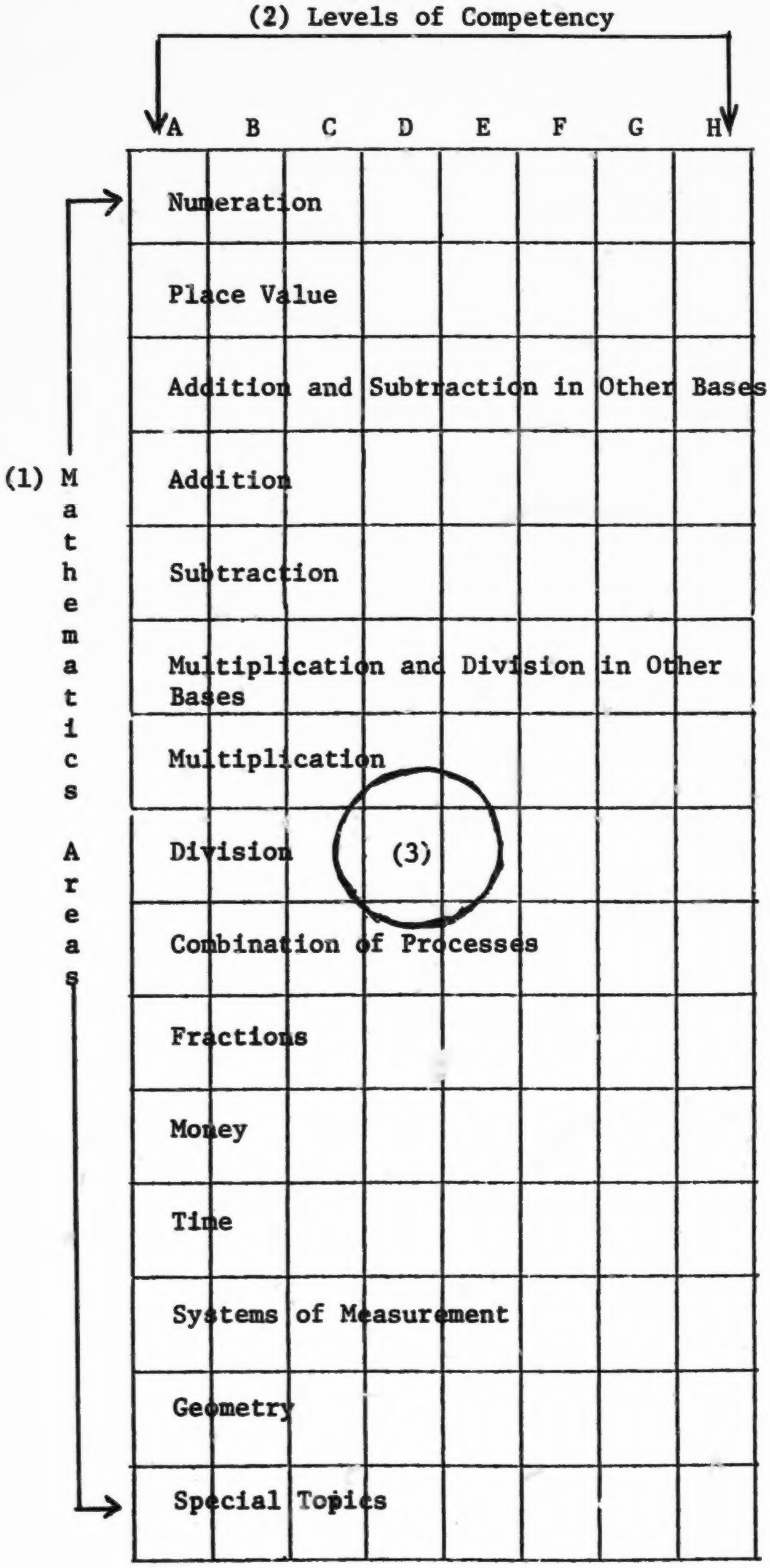
ORGANIZATION OF THE IPI MATHEMATICS CONTINUUM

The IPI Mathematics Continuum has been designed to provide the teacher with a clear set of carefully sequenced behavioral objectives in mathematics. A first step toward using the Continuum is to become familiar with the organization and details of the Continuum.

There are four diagrams in this section:

1. Organization of IPI Mathematics Continuum
2. Sample Unit from IPI Mathematics Continuum
3. IPI Mathematics Continuum (Area Objectives)
4. IPI Mathematics Continuum (Sequence of Units and Skills)

Examine each diagram and explanatory text to learn about the IPI Mathematics Continuum.


(2) Levels of Competency
A
B
C
D
E
F
G
H
(1) Mathematics Areas
Numeration
Place Value
Addition and Subtraction in Other Bases
Addition
Subtraction
Multiplication and Division in Other Bases
Multiplication
Division
(3)
Combination of Processes
Fractions
Money
Time
Systems of Measurement
Geometry
Special Topics

(1) The IPI Mathematics Continuum for kindergarten through grade six is organized into fifteen broad areas from numeration to special topics.

(2) Each area has a possible range of eight levels (A-H) of increasing competency and complexity. These levels approximate traditional grade levels.

(3) The boxes formed by the intersection of an area of mathematics and level of competency are units of behavioral objectives or skills the student must master at that point in the Continuum (refer to Figure 2).

Figure 1: Organization of IPI Mathematics Continuum

The unit circled in Figure 1 and presented below in Figure 2 is a set of Division skills on Level D. The unit contains seven skills.

Level D

Division

1. Divides a set into subsets of equal number to solve simple grouping (division) problems.
2. Uses known multiplication facts to solve division problems related to products to 5 x 10, including 0 and 1.
3. Uses the terms "dividend", "divisor", and "quotient" to label parts of a division problem. Selects division as the proper operation when the division box is used.
4. Solves division problems through combinations of 50÷5 to demonstrate oral and written mastery (no pictures).
5. Divides 2, 3, 4 and 5 by 1 and into 0 and divides a number by itself.
6. Fills in frames for missing quotients. Divisors to 5, dividends to 50, also divisors to 9 when quotients are 5 or less.
7. Solves one-step word problems requiring division facts through 5 x 10.

Figure 2: Sample Unit from IPI Mathematics Continuum

EXERCISE

Summary Sheet for Figures 1 & 2

1. The Continuum has been analyzed and designed in terms of a sequence of ______________.

2. The content of the Continuum has been divided into ________ ____________.

3. The levels of increasing competency run from _________________.

4. A ______________________ in the Continuum is defined as set of behavioral objectives or skills of a given area at a specified level of competency.

5. Numeration is ______________________.
   Special Topics is _______________________.
   F-Time is ___________________.
   The highest level of competency is _____________________.

6. The behavioral objectives within a unit are also called ________________________.

7. Criteria of behavioral objectives and D-Division skills. Fill in criteria matching the skill column.

	Criteria	D-Division Skills
1.	____________________?	All 7 skills describe the student doing something.
2.	____________________?	All 7 skills use action words as solve, fill-in, label, etc.
3.	____________________?	Skill #3 tells us behavior is to occur when division box is used. The other skills do not meet this criterion. In this case, the teacher meets this criterion through the prescription.
4.	____________________?	Students must score 85% or higher on all skill and unit tests in order to move on.

END OF EXERCISE

EXERCISE

(for 1st and 2nd grade teachers)

The following units from Level B are frequently used on your grade level. Apply the four Criteria of Behavioral Objectives in examining them. Discuss your interpretations with the other 1st and 2nd grade teachers. Ask the instructor for help if you need any.

B - Money

1. When presented with the coins (or pictures of) a penny, nickel, and dime, child selects the requested coin.
2. Matches coins; pennies and nickels (or pictures of them) with their numerical value or with value in other coins.
3. Responds to word "quarter" by selecting the correct coin (or picture) from a collection of coins.
4. Finds the value of collections of pennies and nickels and responds to use of "¢" sign. Sums to 12¢.

B - Time

1. Reads numerals to 12 on a clock face (oral).
2. Writes numerals to twelve on a clock face.
3. States that it is after ____ o'clock and before ____ o'clock when presented with a clock face which has only an hour hand pointing between any two numerals on the face. The students should be able to do this very quickly so that a timed test should be used.

B - Systems of Measurement

1. Locates when directed, the following: high, low, near, far; nearest, farthest; big, little; more, less; short, long; smaller, larger; taller, shorter; longer, shorter; right, left.
2. States that a ruler and yardstick are used for measuring and identifies each on request.

3. Says that ruler divisions are inches and that three one-foot rulers are the same length as one yardstick.

4. Identifies "one dozen" and "one-half dozen" objects.

B - Geometry

1. Locates the following figures on request: circle, square, triangle, and rectangle. Responds to these words when used in directions.

2. Reproduces a circle, square, triangle, and rectangle from memory.

END OF EXERCISE

EXERCISE

(for 3rd and 4th grade teachers)

The following units from Level D are frequently used on your grade level. Apply the four Criteria of Behavioral Objectives in examining them. Discuss your interpretations with other 3rd and 4th grade teachers. Ask the instructor for help if you need any.

D - Numeration

1. Reads and writes numbers to 1000. Reads and writes short sequences of numbers from any starting point forward or backward.
2. Completes patterns for skip counting by 3's from any starting point to 1000, forwards or backwards.
3. (D-2) Completes patterns for skip counting by 4's from any starting point to 1000, forwards or backwards.
4. (D-3) Converts pure decimal fractions of tenth to common fractions and words, and vice versa. Fills in missing pure decimal tenths on a number line.
5. (D-3) Converts pure decimal fractions through hundredths to fractions and words, and vice versa.

D - Place Value

1. Identifies the place value of the units, tens, hundreds, and thousands digit in numbers to 1000 by writing the place value in words or numerals when given the digit and by giving the digit when the place value is specified.
2. (D-1) Places or between two numbers to 1000.
3. (D-1) Writes the number which comes "before" or "after" a given number, or "between" two numbers for numbers to 1000.
4. (D-2) Writes numerals in expanded notation (up to 1000) in words or numerals with a + sign.
5. (D-2) Regroups or renames numbers in groups of hundreds, tens, and ones appropriate for borrowing and carrying.

EXERCISE - CONTINUED

(for 3rd and 4th grade teachers)

6. (D-3) Solves addition and subtraction problems related by multiples of ten for combinations not yet studied.

7. (D-4) Writes pure decimal fractions in expanded notation using words, common fractions or decimal fractions.

8. (D-4) Identifies place value of digits of pure decimal fractions to hundredths by writing the place value in words, common fractions or decimal fractions when given the digit.

9. (D-4) Fills place value chart for pure decimal fractions to hundredths.

END OF EXERCISE

EXERCISE

(for 5th and 6th grade teachers)

The following units from Level F are frequently used on your grade level. Apply the four Criteria of Behavioral Objectives in examining them. Discuss your interpretations with other 5th and 6th grade teachers. Ask the instructor for help if you need any.

F - Numeration

1. Rounds numbers to nearest thousands, ten thousands, and mill- for estimating answers in problem form. Rule: rounds up from 5.
2. Writes the standard numeral for a 5, 6, or more place number written in words and writes a 5, 6, or more place number in words.
3. Locates the prime numbers to 100 on a chart by the definition that: "A prime number is one which has exactly two different whole-number factors.

F - Place Value

1. Completes a place value chart for 4 or more digit numbers. A sample form is to be given for all exercises.
2. (E-3) Writes 10 multiplied by itself a number of times as 10 to a power, for all positive powers of 10 (not to include zero). Identifies the base and the exponent or power of a term.
3. Writes a number with one non-zero digit as a whole number less than 10 times a power of 10- i.e., 7×10^3.
4. Writes a number from 1 through 9 multiplied by itself a number of times in exponential form.
5. (F-2,5) Reads and charts decimal numbers to millionths with whole number parts to ten. Sample to be given for all exercises.

F - Addition

1. Adds with carrying for four or more place numbers with more than two addends.

EXERCISE - CONTINUED

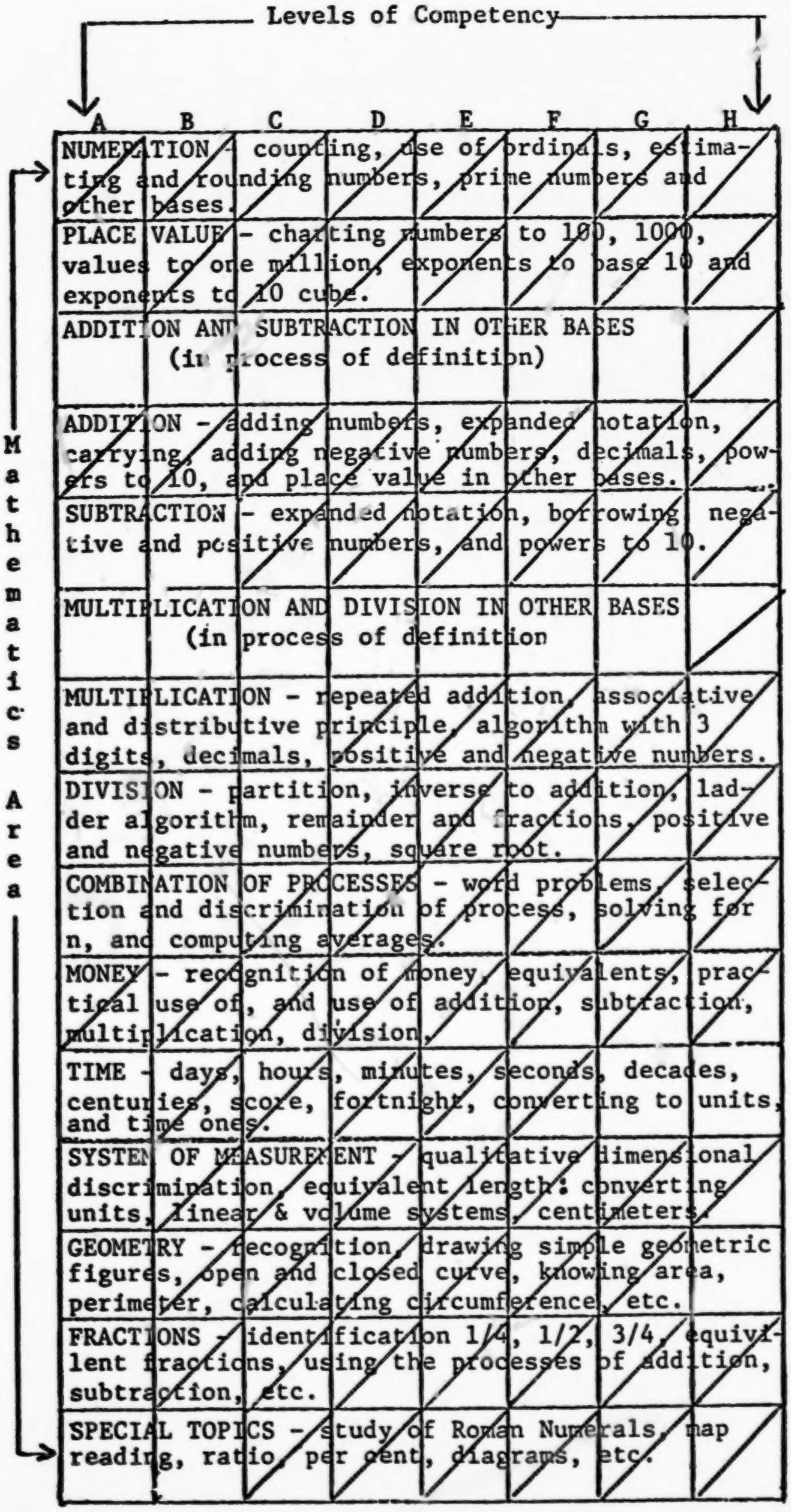
(for 5th and 6th grade teachers)

2. Adds two or more numbers with whole number parts and decimals to the millionths. Addends need not have same number of digits. Maximum of 7 digits.

F - Subtraction

1. Subtracts two decimal numbers with whole number parts and decimals to the millionths. Terms need not have same number of digits. Maximum of 7 digits.

END OF EXERCISE



NUMERATION - counting, use of ordinals, estimating and rounding numbers, prime numbers and other bases.

PLACE VALUE - charting numbers to 100, 1000, values to one million, exponents to base 10 and exponents to 10 cube.

ADDITION AND SUBTRACTION IN OTHER BASES (in process of definition)

ADDITION - adding numbers, expanded notation, carrying, adding negative numbers, decimals, powers to 10, and place value in other bases.

SUBTRACTION - expanded notation, borrowing, negative and positive numbers, and powers to 10.

MULTIPLICATION AND DIVISION IN OTHER BASES (in process of definition)

MULTIPLICATION - repeated addition, associative and distributive principle, algorithm with 3 digits, decimals, positive and negative numbers.

DIVISION - partition, inverse to addition, ladder algorithm, remainder and fractions, positive and negative numbers, square root.

COMBINATION OF PROCESSES - word problems, selection and discrimination of process, solving for n, and computing averages.

MONEY - recognition of money, equivalents, practical use of, and use of addition, subtraction, multiplication, division,

TIME - days, hours, minutes, seconds, decades, centuries, score, fortnight, converting to units, and time ones.

SYSTEM OF MEASUREMENT - qualitative dimensional discrimination, equivalent length: converting units, linear & volume systems, centimeters.

GEOMETRY - recognition, drawing simple geometric figures, open and closed curve, knowing area, perimeter, calculating circumference, etc.

FRACTIONS - identification 1/4, 1/2, 3/4, equivilent fractions, using the processes of addition, subtraction, etc.

SPECIAL TOPICS - study of Roman Numerals, map reading, ratio, per cent, diagrams, etc.

Each of the fifteen areas of IPI mathematics is rather broadly defined. However, each area has been analyzed into specific behavioral objectives or skills, and grouped into units of increasing competencies. The boxes with the diagonal lines represent the units of skills existing in each area. For example, numeration contains skills at every level of difficulty. While multiplication and division each start with units of skills at Level D. Examine the chart to see how the units of skills are distributed through the Continuum.

Figure 3: IPI Mathematics Continuum (Area Objectives)

Levels of Competency

Mathematics Areas

	A	B	C	D	E	F	G	H
Num.	1 / 9	4 / 9	12 / 7	23 / 5	36 / 8	49 / 3	62 / 8	74 / 4
P.V.		5 / 2	13 / 5	24 / 9	37 / 7	50 / 5	63 / 2	75 / 1
+ & − Other Bases								76 / 6
Add.	2 / 2	6 / 11	14 / 5	25 / 8	38 / 6	51 / 2	64 / 3	77 / 2
Sub.			15 / 4	26 / 5	39 / 3	52 / 1	65 / 3	78 / 1
× & ÷ Other Bases								79 / 5
Mult.				27 / 8	40 / 11	53 / 10	66 / 6	80 / 3
Div.				28 / 7	41 / 7	54 / 9	67 / 5	81 / 5
COP			16 / 6	29 / 5	42 / 7	55 / 4	68 / 5	82 / 6
Frac.	3 / 2	7 / 1	17 / 5	30 / 5	43 / 6	56 / 14	69 / 5	83 / 2
M.		8 / 4	18 / 3	31 / 6	44 / 4	57 / 1		
T.		9 / 3	19 / 5	32 / 10	45 / 9	58 / 5	70 / 3	84 / 1
SOM		10 / 4	20 / 3	33 / 5	46 / 7	59 / 3	71 / 2	
Geom.		11 / 2	21 / 2	34 / 3	47 / 9	60 / 10	72 / 7	85 / 9
S.T.			22 / 1	35 / 3	48 / 3	61 / 5	73 / 4	86 / 5

The units in IPI mathematics are carefully sequenced. The sequence of units is presented in Figure 4. The numbers in the upper left-hand corner of each unit give the numerical order in which the units are mastered. Mastery of each unit is generally dependent upon mastery of the preceding unit. For example, if a student is working in B-Frac. (Unit 7), he has mastery of Units 1-6. After mastering B-Frac. (Unit 7), he will move into the next unmastered unit.

The numbers in the lower right-hand corner of each unit indicate the number of skills to be mastered. For example, D-Num. (Unit 23) contains five skills.

Figure 4 indicates there are 86 units and 436 skills in the Continuum to date. The Continuum is periodically reviewed and revised. Feedback from IPI teachers helps RBS and LRDC in these revisions of the mathematics program.

Figure 4: IPI Mathematics Continuum (Sequence of Units and Skills)

EXERCISE

Summary Sheet for Figure 3 & 4

1. __________________________ are broadly defined in the Continuum.

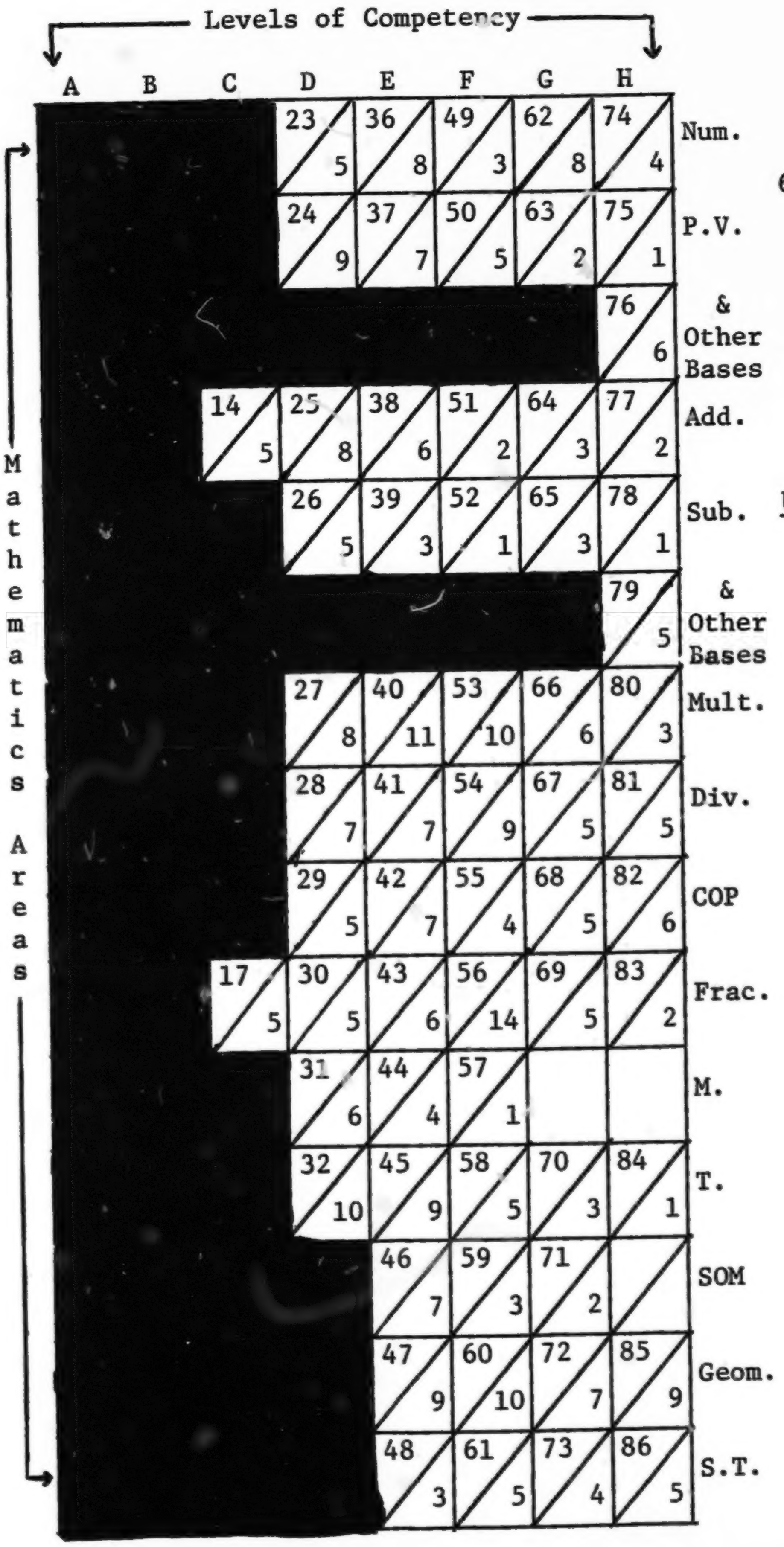
2. The ___________________________ are carefully sequenced from 1 to 86.

3. A student who is ready to start work on the skills in F-Addition must have mastered all the skills in Units 1 to __________________.

4. The number of units in TIME is ________________. They run from Level ______________________ to _______________________.

5. The units contain different numbers of ______________________.

6. (See Chart on following page.)



Levels of Competency

Mathematics Areas

	A	B	C	D	E	F	G	H
Num.	▨	▨	▨	23 5	36 8	49 3	62 8	74 4
P.V.	▨	▨	▨	24 9	37 7	50 5	63 2	75 1
& Other Bases	▨	▨	▨	▨	▨	▨	▨	76 6
Add.	▨	▨	14 5	25 8	38 6	51 2	64 3	77 2
Sub.	▨	▨	▨	26 5	39 3	52 1	65 3	78 1
& Other Bases	▨	▨	▨	▨	▨	▨	▨	79 5
Mult.	▨	▨	▨	27 8	40 11	53 10	66 6	80 3
Div.	▨	▨	▨	28 7	41 7	54 9	67 5	81 5
COP	▨	▨	▨	29 5	42 7	55 4	68 5	82 6
Frac.	▨	▨	17 5	30 5	43 6	56 14	69 5	83 2
M.	▨	▨	▨	31 6	44 4	57 1		
T.	▨	▨	▨	32 10	45 9	58 5	70 3	84 1
SOM	▨	▨	▨	▨	46 7	59 3	71 2	
Geom.	▨	▨	▨	▨	47 9	60 10	72 7	85 9
S.T.	▨	▨	▨	▨	48 3	61 5	73 4	86 5

6. A student shows he has mastered all the shaded units on this chart. He should master all the units in one level before working through successive units. The student, represented on this chart, would master the units in this order:

Unit No.	Name	No. of Skills
14	C-Add.	5
17	C-Frac.	5
____	____	____
____	____	____
____	____	____
____	____	____
____	____	____
____	____	____
____	____	____
____	____	____
____	____	____
____	____	____
____	____	____
____	____	____
____	____	____
39	E-Sub.	3

etc.

POSTTEST: Section II: Organization of the IPI Mathematics Continuum

The following items constitute a posttest.

The answer key which accompanies the test is correlated to the instructional materials in this section. Based upon the right and wrong responses you have made on the test, the answer key will direct you to those pages on which you should work to achieve 100% mastery.

Use the directions given with the pretest.

	A	B	C	D	E	F	G	H
Numeration								
Place Value								
Addition and Subtraction in Other Bases								
Addition								
Subtraction								
Multiplication & Division in Other Bases								
Multiplication								
Division								
Combination of Processes								
Fractions								
Money								
Time								
Systems of Measurement								
Geometry								
Special Topics								

Mathematics Continuum

Complete the following statements by writing the appropriate answer in the column of blanks provided on the right. Use the graph to find the answers.

1. The areas range from (a)_____ to (b)_____ (a)________ (b)________
2. (a)_____ is the box formed by the intersection of an area of mathematics and level of competency. (a)________
3. C-Fractions is (a)_____ (a)________
4. Multiplication is (a)_____ (a)________

Complete the following statements by writing in appropriate answer in the column of blanks provided on the right.

5. (a) ____________ are broadly defined in the Continuum. (a) ______________

6. The units contain different numbers of (a) ___________ (a) ______________

7. At present there are (a) ___________ skills in the Continuum (a) ______________

Answer True or False

8. Generally to master a unit a student must have mastered the preceding units ______________

9. Multiplication contains skills at every level of difficulty ______________

10. Each unit contains five skills ______________

ANSWER KEY

POSTTEST: Section II: Organization of the IPI Mathematics Continuum

(pp. ~~123~~-139)
126

1. A-H
2. unit
3. unit
4. area
5. areas
6. skills
7. 436
8. True
9. False
10. False

TEACHING IN IPI

Package 2: Summary Sheet

A behavioral objective describes an overt activity or observable product executed by the learner under a specific set of conditions with a stated degree of mastery.

Criterion questions for a behavioral objective:

1. Who is doing the behaving?
   (Learner)
2. Is the learner doing or producing something?
   (Overt behavior or observable product)
3. Under what conditions is the behavior to occur?
   (Situational factors that will elicit the behavior)
4. What is the mastery criterion?
   (Minimum acceptable competency)

IPI Mathematics Continuum is a carefully sequenced set of behavioral objectives in mathematics organized into areas of mathematics and levels of competency.

There are fifteen Mathematics Areas or subdivisions of the content in the Continuum (Numeration, Place Value, etc.) Each Area has a possible range of eight Levels of Competency (A-H). A particular Level of Competency in any one Area is a Unit (D-Numeration, A-Add., etc.) A Unit is composed of a set of Skills (D-Multiplication has eight Skills, G-Fraction has five Skills, etc.)

A student works on Units he has yet to master in the order in which they are sequenced in the Continuum.

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